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WAR MACHINE

An ORBIS Publication
109
90p
IR £1.15 Aus $2.15 NZ $2.65 SA R2.45 Sing $4.50

Armed Forces of the World: West Germany (Part 3)

The Tripartite Minehunter

Soviet Minelayers in Action

Minesweeping Techniques

A fully illustrated guide to Mine Warfare Vessels

WAR MACHINE

Volume 10 **Issue 109**

Published by
Orbis Publishing Ltd
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London W6 0ES

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Colour Origination: Imago Publishing Ltd, Thame, Oxon

Typesetting: SX Composing Ltd

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38510

Printed in Great Britain
by The Artisan Press Ltd

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Picture acknowledgements

Cover photograph: ECP Armée. **2161:** ECP Armée/ECP Armée. **2162:** MARS, Lincs/MARS, Lincs/MARS, Lincs. **2163:** ECP Armée. **2164:** MARS, Lincs/ECP Armée. **2165:** MARS, Lincs. **2166:** Royal Netherlands Navy-MARS, Lincs/DTCN-MARS, Lincs/Royal Netherlands Navy-MARS, Lincs. **2167:** US Navy. **2168:** US Navy/US Navy. **2169:** MARS, Lincs/US Navy. **2170:** MoD. **2172:** US Navy. **2173:** US Navy/US Navy. **2174:** US Navy. **2176:** MoD/MoD. **2177:** MoD. **2178:** Imperial War Museum. **2179:** US Navy. **2180:** Italian Navy. **(iii):** MARS, Lincs/MARS, Lincs. **(iv):** MARS, Lincs/MARS, Lincs.

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Modern Mine Warfare Vessels

The 'Circé' class minehunters of the French navy use a remote control submarine to detect enemy mines and lay a demolition charge nearby. The submarine is then recalled and the charge detonated by an ultrasonic signal, destroying the mine.

Throughout the 20th century seamines have been of great importance in naval warfare. Without adequate mine countermeasures, ports can be blockaded, sea lanes disrupted and priceless warships destroyed at little cost to the enemy. Today it is a disturbing truth that most Western powers do not devote enough resources to mine countermeasures, while the Soviet Union has steadily increased its capacity.

Since World War II the leading Western nations (including the UK and USA) have tended somewhat to downgrade the importance of mine warfare and the mine countermeasures (MCM) techniques needed to counter it. Unfortunately their opinion is that a large fleet of small MCM vessels is labour-intensive, and in times of cash limitations the navies generally maintain what they consider to be their most important combat assets, namely carriers, submarines and the larger surface combatants. Under most circumstances this would be acceptable, but in this instance the principal mining threat to Europe and the North American continents comes from the USSR, a nation which has a total seamine inventory of considerably more than 400,000 weapons layable in all depths of water according to the intended target.

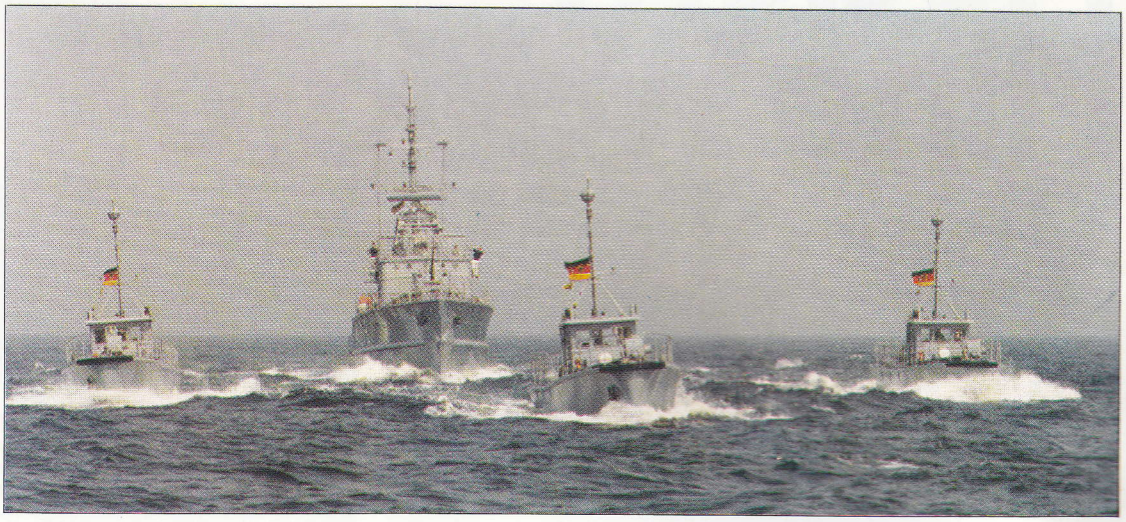
If one considers just the Royal Navy, then its projected fleet of some 40 to 50 'Hunt' class MCMVs, 'River' class fleet minesweepers and a new type of single-role minehunter would be hard pressed to keep open the required number of ports needed just to reinforce and resupply Europe, let alone the naval bases and submarine transit routes as well. Similarly, the US neglect of its MCM fleet over the years and the pitifully small number of new vessels ordered, would make it impossible for the US Navy to keep open the ports from which the resupply convoys would sail, and all the home and foreign naval bases needed to sustain a maritime conflict.

In complete contrast the USSR has not only maintained its offensive capabilities but also its defensive forces, by continuously upgrading its MCM fleet with new designs at regular intervals. Although possibly these are not as good in quality as Western vessels, the large unit numbers more than make up for this.

The Tripartite minehunters are an unusual exercise in collaboration: Belgium provides most of the electronics, France the minehunting equipment, and the Netherlands the propulsion systems. This is Eridan, *the first Tripartite to enter service with the French navy.*

WEST GERMANY

'Lindau' (Type 320) class



The **'Lindau'** or **(Type 320) class** of minesweepers were the first Federal German navy vessels to be built in Germany after World War II. Basically constructed to a NATO standard design with modifications for West German service, they have a wooden hull and a superstructure of non-magnetic materials. In 1968-9 the ***Fulda*** (M1086) was converted to a **'Type 331A' class** minehunter with the ***Flensburg*** (M1084) following in 1970-1. This proved so successful that in 1976-9 a further 10 vessels were modified to a similar standard but without the retractable Scholtel propeller system for low-speed manoeuvring. These units are the ***Lindau*** (M1072), ***Tübingen*** (M1074), ***Minden*** (M1085), ***Koblenz*** (M1071), ***Göttingen*** (M1070), ***Cuxhaven*** (M1078), ***Weilheim*** (M1077), ***Marburg*** (M1080), ***Völklingen*** (M1087) and ***Wetzlar*** (M1075), and are classed as **'Type 331B' class** minehunters. None of the two sub-classes has any mechanical sweep gear aboard, but instead carries six divers, a hydraulic crane and two French remote-controlled submersibles to work with the minehunting sonar. A more advanced submersible for mine-disposal work is being tested by the West German navy under the name Penguin.

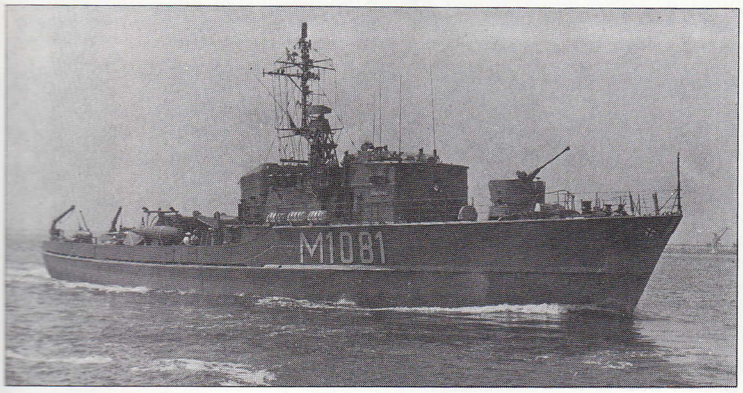
From 1979 to 1983 the remaining six vessels of the 'Lindau' class, the ***Schleswig*** (M1073), ***Paderborn*** (M1076), ***Düren*** (M1079), ***Konstanz*** (M1081), ***Wolfsburg*** (M1082) and ***Ulm*** (M1083) were converted to the **'Type 351' class** drone minesweeper control vessel configuration. Each of these vessels is able to control up to three F-1 Troika magnetic/acoustic/mechanical minesweeper drones as well as carrying and using an SGD-21 Oropesa mechanical sweep and an acoustic generator system. The drones (numbered Seehund 1-18) are in a pool from which craft are drawn as required. All 18 units of the 'Lindau' subclasses are based with the West Germans' North Sea MCM squadron.

Specification

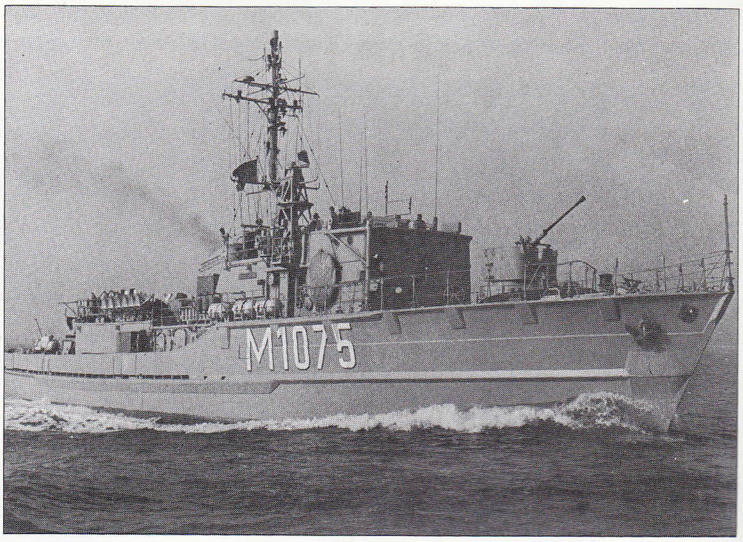
'Type 331A/B' class
Displacement: 388 tons standard and 463 tons full load
Dimensions: length 47.1 m (154.5 ft); beam 8.3 m (27.2 ft); draught 3.0 m (9.8 ft)
Propulsion: two diesels delivering 2983 kW (4,000 hp) to two shafts
Speed: 17 kts
Armament: one 40-mm Bofors AA gun
Electronics: one TSR/N or Kelvin Hughes 14/9 navigation radar, one Type 193M ('Type 331A') or DSQS-11 ('Type 331B') minehunting sonar, and two PAP 104 mine-disposal systems
Complement: 46

'Type 351' class
Displacement: 388 tons standard and 488 tons full load
Dimensions: length 47.1 m (154.5 ft); beam 8.3 m (27.2 ft); draught 2.8 m (9.2 ft)
Propulsion: two diesels delivering 2983 kW (4,000 hp) to two shafts
Speed: 16.5 kts
Armament: one 40-mm Bofors AA gun
Electronics: one TSR/N navigation radar, one drone-control radio system, and one DSQS-11 minehunting sonar
Complement: 43

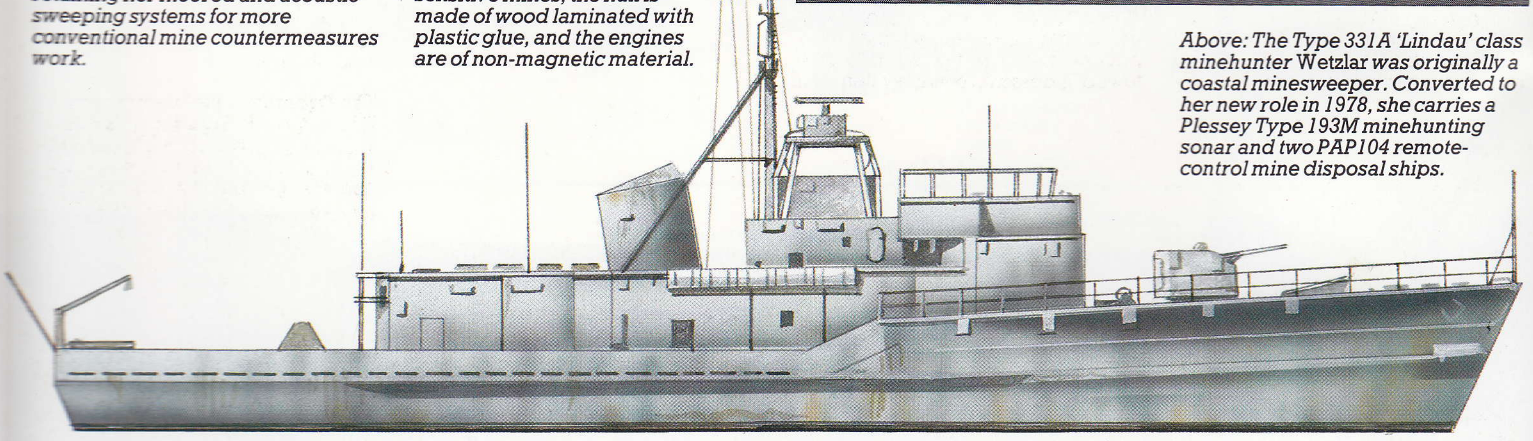
A Type 351 Troika control ship is seen with her three charges in front. For passage to a sweep area, the drones carry a crew of three which is taken off for operations. The unmanned vessels are then used mainly for magnetic minesweeping.



The 'Lindau' class minesweeper Konstanz is seen after her conversion to a Type 351 Troika control ship. As such she can guide up to three of the minesweeping drones, as well as retaining her moored and acoustic sweeping systems for more conventional mine countermeasures work.



Above: The Type 331A 'Lindau' class minehunter Wetzlar was originally a coastal minesweeper. Converted to her new role in 1978, she carries a Plessey Type 193M minehunting sonar and two PAP104 remote-control mine disposal ships.



Below: Lindau was the first German-built vessel to join the German navy after World War II. To reduce vulnerability to metal-sensitive mines, the hull is made of wood laminated with plastic glue, and the engines are of non-magnetic material.

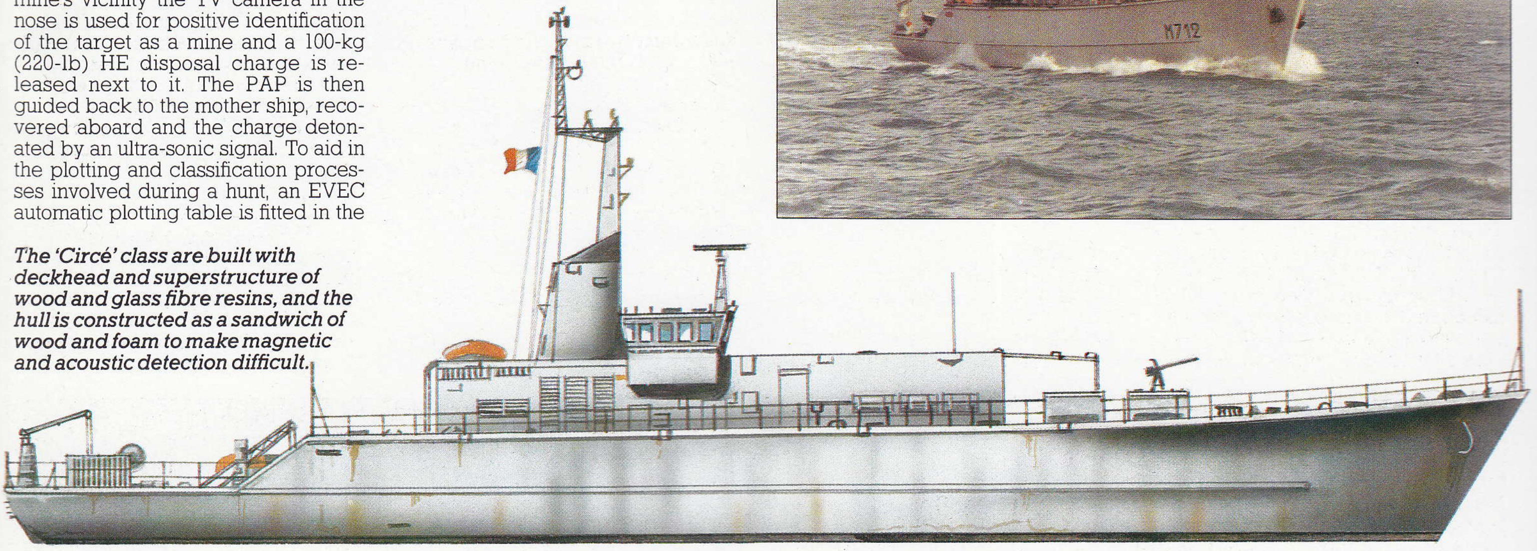
FRANCE

'Circé' class

The first of the **'Circé' class** minehunters were ordered in 1968, the five units were the ***Cybèle*** (M712), ***Calliope*** (M713), ***Clio*** (M714), ***Circé*** (M715) and ***Ceres*** (M716), these being commissioned into service during 1972-3. They are designed solely for the hunting and destruction of ground and moored mines laid to depths of about 60 m (197 ft). To locate the mines a DUBM 20 minehunting sonar is carried. Once located the mines are either destroyed by the six-strong detachment of divers (together with Gemini dinghies) or one of the two remote-controlled 6-kt PAP 104 submersibles. These weigh 700 kg (1,543 lb) are 2.7 m (8.9 ft) long and 1.1 m (3.6 ft) in diameter. Following the initial detection, they are lowered over the side aft by a large hydraulic winch mounted on the centreline. The PAP is then guided towards the contact via a 500-m (1640-ft) cable. Once in the mine's vicinity the TV camera in the nose is used for positive identification of the target as a mine and a 100-kg (220-lb) HE disposal charge is released next to it. The PAP is then guided back to the mother ship, recovered aboard and the charge detonated by an ultra-sonic signal. To aid in the plotting and classification processes involved during a hunt, an EVEC automatic plotting table is fitted in the sonar and operations control room, which is located in the superstructure forward of the bridge. To reduce the magnetic and acoustic signatures of the vessels their hulls were constructed in a sandwich of wood and foam, the outer skin being covered by a thin film of GRP. The deckhead and superstructure are a composite of wood and glassfibre resin. All the propulsion systems can be operated from the bridge or a soundproofed control room located above the main deck.

Circé was built in the early 1970s and is one of a class of five vessels that were constructed solely for the minehunting role. As such, they carry no normal minesweeping equipment such as sweeps.

Specification
'Circé' class
Displacement: 460 tons standard and 510 tons full load
Dimensions: length 50.9 m (167.0 ft); beam 8.9 m (29.2 ft); draught 3.4 m (11.2 ft)
Propulsion: one diesel delivering 1342 kW (1,800 hp) to one shaft, and an auxiliary 'active rudder' system for minehunting
Speed: 15 kts
Armament: one 20-mm AA gun
Electronics: one Decca 1229 navigation radar, one DUBM 20A minehunting sonar, and two PAP 104 mine-disposal systems
Complement: 48



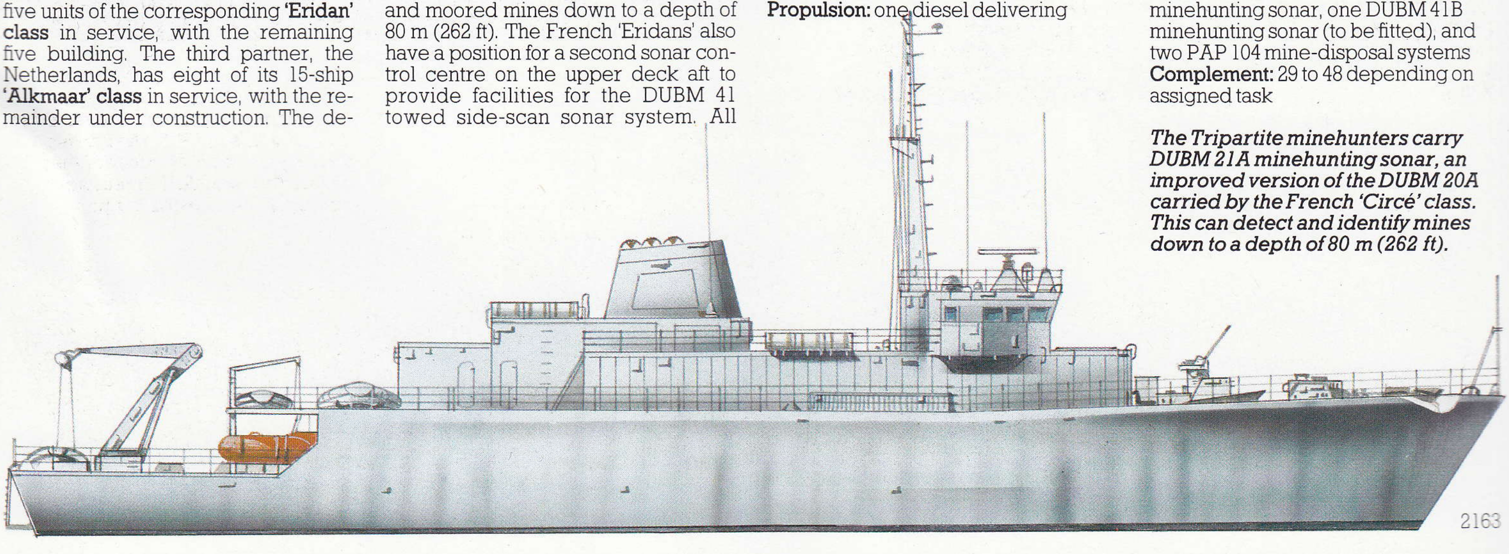
The 'Circé' class are built with deckhead and superstructure of wood and glass fibre resins, and the hull is constructed as a sandwich of wood and foam to make magnetic and acoustic detection difficult.

BELGIUM/FRANCE/NETHERLANDS

Tripartite minehunter

A collaborative venture between the French, Belgian and Netherlands navies, the **Tripartite minehunter** design is gradually replacing the old ocean and coastal minesweepers built during the 1950s. Belgium is scheduled to get 10 units of the **'Aster' class**, of which the first five have already been laid down or launched. There is the possibility of a follow-on order for another five later. France already has five units of the corresponding **'Eridan' class** in service, with the remaining five building. The third partner, the Netherlands, has eight of its 15-ship **'Alkmaar' class** in service, with the remainder under construction. The design has the hull, decks and partitions made out of some 180 tons of a glass weave/polyester resin (GRP) compound, and the propulsion system is essentially the same as that fitted to the French 'Circé' class of minehunters. A DUBM 21A minehunting sonar (smaller and more advanced than the DUBM 20A fitted to the 'Circés') is carried as a retractable hull system. The DUBM 21A can detect and classify ground and moored mines down to a depth of 80 m (262 ft). The French 'Eridans' also have a position for a second sonar control centre on the upper deck aft to provide facilities for the DUBM 41 towed side-scan sonar system. All three classes also carry one light mechanical drag sweep to deal with conventional moored mines.

Specification
'Eridan' class
Displacement: 510 tons standard and 544 tons full load
Dimensions: length 51.6 m (169.3 ft); beam 8.9 m (29.2 ft); draught 2.5 m (8.2 ft)
Propulsion: one diesel delivering 1417 kW (1,900 hp) to one shaft, and an auxiliary 'active rudder' system for minehunting
Speed: 15 kts
Armament: one 20-mm AA, and two 12.7-mm (0.5-in) machine-guns
Electronics: one Decca 1229 navigation radar, one Toran radio navigation system, one Syledis radio navigation system, one Decca Hi-fix navigation system, one DUBM 21A minehunting sonar, one DUBM 41B minehunting sonar (to be fitted), and two PAP 104 mine-disposal systems
Complement: 29 to 48 depending on assigned task



The Tripartite minehunters carry DUBM 21A minehunting sonar, an improved version of the DUBM 20A carried by the French 'Circé' class. This can detect and identify mines down to a depth of 80 m (262 ft).

The Tripartite Minehunter

France, Belgium and the Netherlands have combined to produce a minehunter design to replace the old US-built minesweepers supplied during the 1950s. All three navies have now taken delivery of their respective sub-classes, and the French navy has used two,* Eridan *and* Cassiopée*, in action during the international operation to clear the Red Sea of mines laid by a Libyan freighter in 1984.

In a relatively unusual show of European collaboration, the French, Belgian and Netherlands navies have joined together to design and build a minehunter to replace the ex-US ocean and coastal minesweeper vessels that were supplied to them in the 1950s as part of a NATO MCM programme. Although initial construction was delayed somewhat by problems associated with the original consortium, all three navies have now taken delivery of vessels comprising their individual subclasses. Under the terms of the manufacturing agreement each country builds its own series of GRP hulls to a standard design. The French are then responsible for the ships' minehunting and mine disposal gear together with the electronics, the Dutch for the main propulsion systems, and the Belgians for the auxiliary minehunting propulsion units and the electrical generating plant.

Hull structure

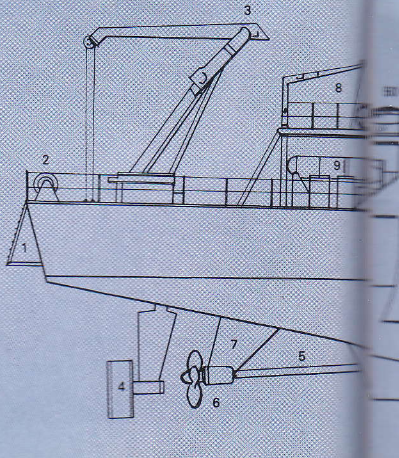
The hull is moulded in a steel shell and together with the decks and internal partitions is formed from a single thickness of GRP between 20 and 40 mm (0.79 and 1.57 in) thick. Stiffening is provided by trapezoidal-section formers which are connected to the hull by reinforcing fibreglass pins. The two independent propulsion systems fitted are similar to those used in the French 'Circé' class minehunters: the auxiliary system is used during hunting operations, while the main propulsion plant is used for normal running. The latter has a single main shaft which turns a five-blade controllable-pitch propeller that can be 'feathered' when the auxiliary plant is in operation. The main system is controlled solely from the bridge, while the auxiliary system can be controlled from either the bridge or the central operations room depending upon circumstances. The electric motors for the secondary propulsion plant are driven by three Astazou IVB 200-shp (149-kW) gas-turbine alternators.

The motors drive two special 'active' rudder arrangements each with a small screw-propeller mounted at its base to give a maximum hunting speed of 7 kts. To increase the vessel's manoeuvrability further a pair of bow thruster units is fitted. A fourth Astazou alternator supplies the ship with power at cruising speeds or at anchor.

The main minehunting system carried is the Thomson-CSF DUBM 21A sonar. This is retracted into a well in the hull for cruising, and is used in conjunction with precision navigation systems of various types during a hunt. It is capable of detecting moored and ground mine-like objects at distances up to 600 m (1,969 ft), and in water depths down to 80 m (262 ft). Classification of the object as a mine can be made by studying the shape of its echo and acoustic shadow from distances up to 250 m (820 ft). The ships of the French class each have a second position for a sonar control centre on the upper deck aft. This is to be used for the Thomson-CSF DUBM 41B high-resolution side-looking towed sonar system. Two streamlined bodies are streamed astern to the left and right of the ship's track. Containing sonars which operate on frequencies 50 kHz apart, these scan the area of the seabed between the two bodies. A typical scanned area amounts to a total width of some 200 m (656 ft). The DUBM 41B can be used in water depths of 100 m (328 ft) or more, the towed sensor following the contours of the bottom at a height of 5.5-7.5 m (18-25 ft) at speeds between 2 and 6 kts. To destroy the mines once they have been detected, the vessel has on board a diving team of six (for the hand-placing of HE charges from Gemini dinghies) or two PAP 104 remotely controlled mine-disposal vehicles, these being carried on the stern fantail working area. For them a total of 27 100-kg (220-lb) HE charges are carried in the ship's magazine. A light mechanical sweep wire is also carried for moored contact mines. A limited self-defence armament of a single 20-mm AA gun is carried.

Above: The Eridan *is leadship of the Tripartite minehunter class for the French navy. Several units of the class have been involved in the hunt for mines laid by the Libyan ferry* Ghat *in the Red Sea during late 1984.*

Left: The French class have a second position for a sonar control centre on the upper deck aft, which is to be used for the Thomson-CSF DUBM 41B high-resolution side-looking towed sonar system. This can scan a width of sea bed up to 200 m (219 yards).



As a result of dissolution of the original Polyship consortium, the Belgian navy had to reorder its 10 vessels from the Béliard Shipyard at Ostend, which builds and launches the vessels, the fitting out being performed by Béliard Mercantile at Rupelmonde, Antwerp. The first unit, *Aster* (M915), was laid down in February 1983 and launched in 1984. The other nine building are the *Bellis* (M916), *Crocus* (M917), *Dianthus* (M918), *Fuchsia* (M919), *Iris* (M920), *Lobelia* (M921), *Myosotis* (M922), *Narcis* (M923) and *Primula* (M924). An option on a further five has been taken for confirmation as an order when funding permits.

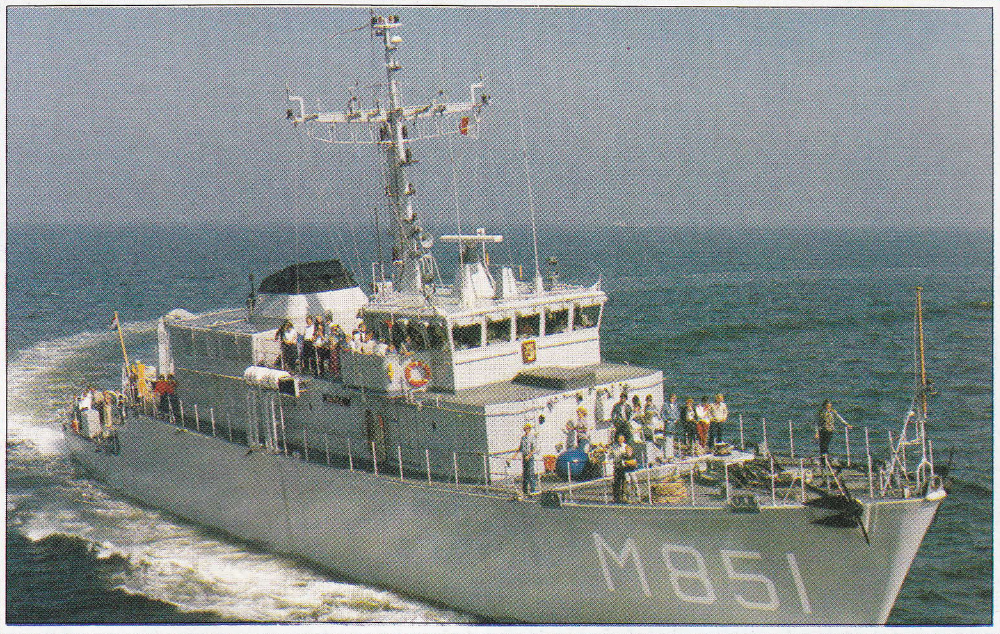
In the French navy the Tripartite design has been assigned the name 'Eridan' class. The first five are the *Eridan* (M641), *Cassiopée* (M642), *Andromede* (M643), *Pégase* (M644) and an unnamed vessel, all in service or launched. Another five are on order with deliveries due at regular intervals over the next year or two. Following a request from the Egyptian government, two units, the *Eridan* and *Cassiopée*, were used by the French navy in conjunction with the minehunters *Cantho* and *Dompaire* and the support ships *Liseron* and *Loire* during the late-1984 international hunt for the Libyan-laid Soviet ground mines in the Red Sea.

'Alkmaar' class

The corresponding Dutch class is the 15-ship 'Alkmaar' class, which is being built by Van der Giessen-de Noord Alblasserdam in a specially constructed 'ship factory'. The first unit, *Alkmaar* (M850), was laid down in 1979, launched in an essentially complete condition in 1982 and commissioned into service in 1983. The remaining 14 units are the *Delfzyl* (M851), *Dordrecht* (M852), *Haarlem* (M853), *Harlingen* (M854), *Scheveningen* (M855), *Maassluis* (M856), *Makkum* (M857), *Middleburg* (M858), *Hellevoetshuis* (M859), *Schiedam* (M860), *Urk* (M861), *Zieriksee* (M862), *Vlaadingen* (M663) and *Willemstad* (M864), and these have been commissioned at regular intervals, replacing older vessels paid off for scrap.

All three classes also have the capability to carry on the deck aft a 5-ton container. This can be used to permit additional tasks (such as MCMV HQ ship, research, coastal patrol, extended diving support, pollution control or direction of unmanned minesweeper drones) as well as to increase the type's flexibility. To improve the close-range air defence of the Dutch 'Alkmaars', consideration is being given to the fitting of a short-range point-defence SAM missile-launcher system, which would increase the suitability of the class for patrol duties in wartime. Depending on the main and secondary roles assigned to the ships, the complement can be varied between 29 and 48.

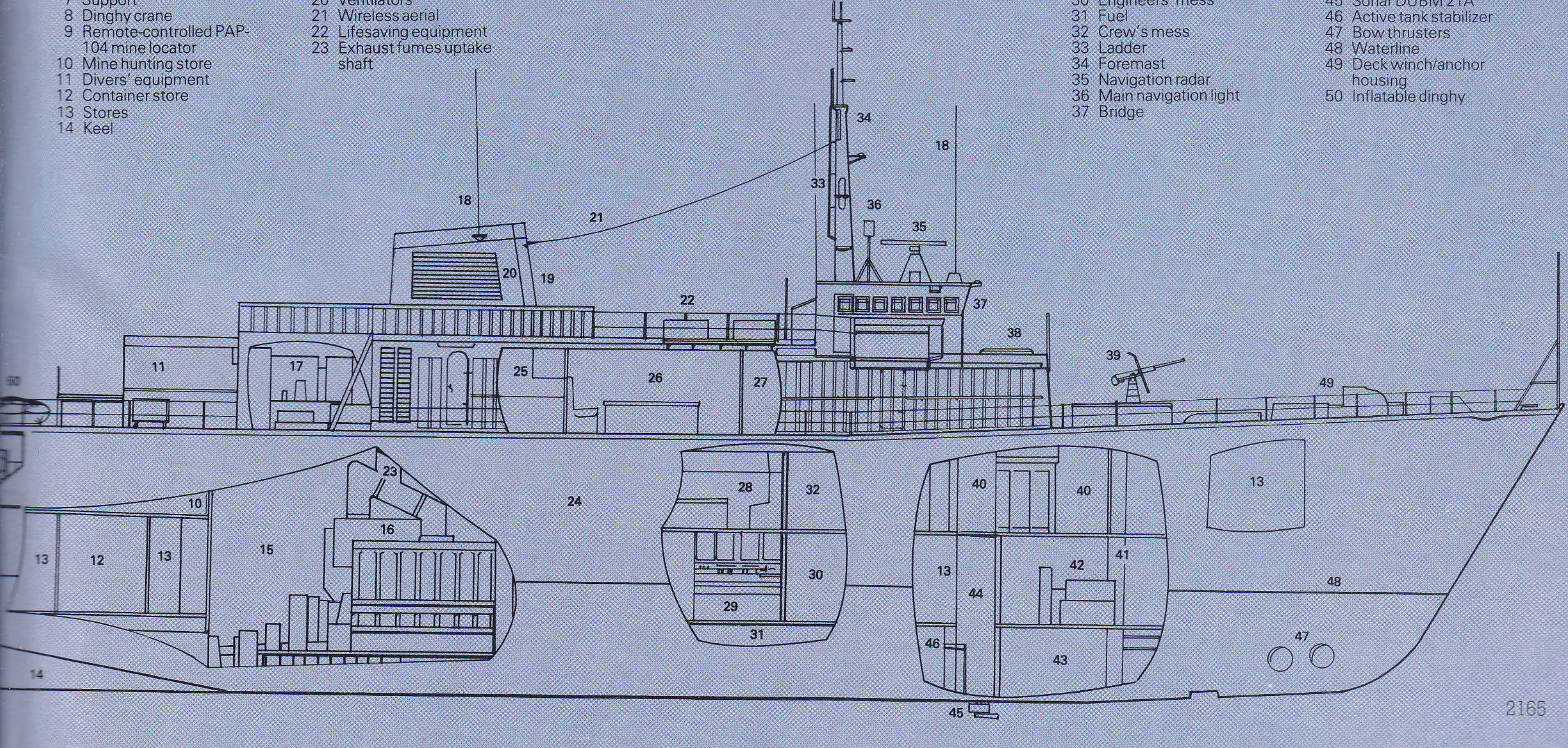
If the design proves satisfactory, then further ships may well be built in all three countries to an improved specification to replace the 1960s-generation MCM vessels still in service.

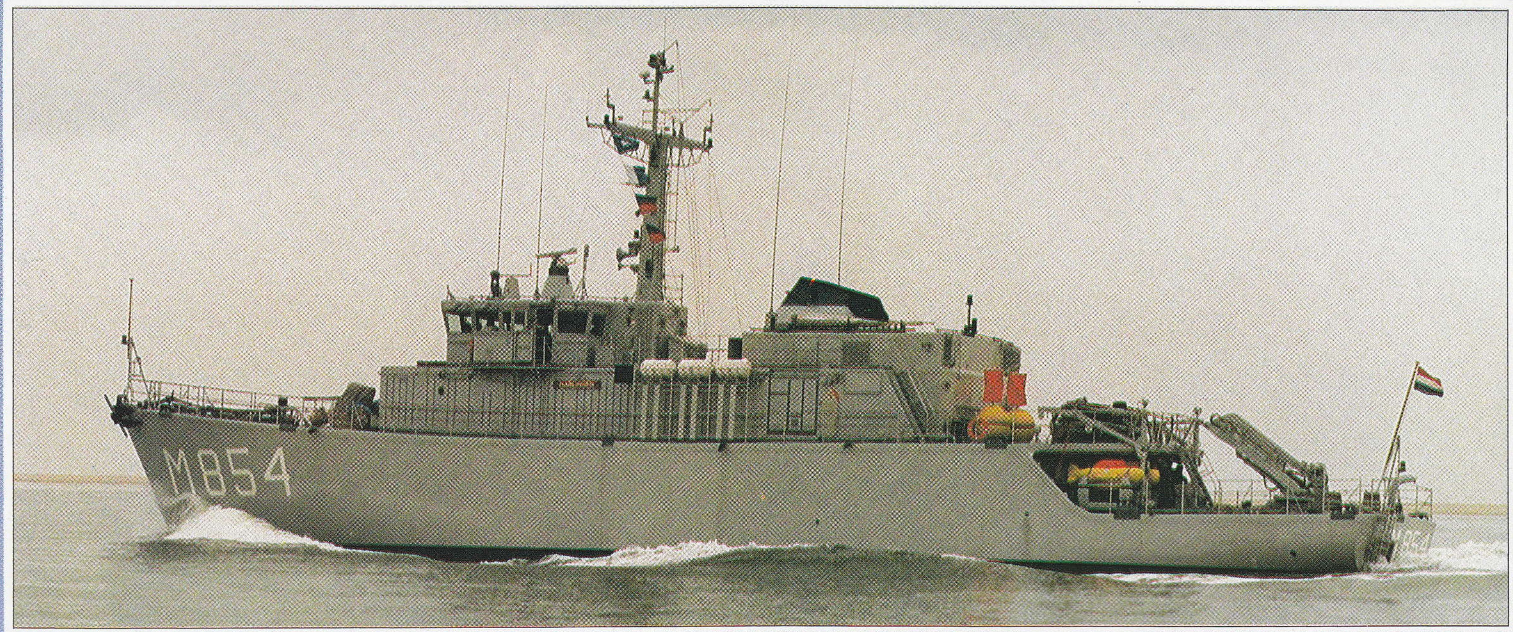


***Alkmaar** is the first of 15 Dutch navy Tripartite minehunters. By mid-1985 eight had been commissioned, with a ninth due by the end of the year. Dutch units differ from the other navies' ships in being able to be configured for other tasks as well.*

Tripartite minehunter cutaway drawing key

1 Ladder
2 Winch
3 Crane
4 Twin manoeuvring props (active rudder)
5 Single shaft
6 Screw
7 Support
8 Dinghy crane
9 Remote-controlled PAP-104 mine locator
10 Mine hunting store
11 Divers' equipment
12 Container store
13 Stores
14 Keel
15 Engine room
16 Werkspoor 2,280-hp (1700-kW) diesel engine
17 Twin auxiliary motor room (222 hp/166 kW)
18 Whip aerial
19 Funnel casing
20 Ventilators
21 Wireless aerial
22 Lifesaving equipment
23 Exhaust fumes uptake shaft
24 Glass-reinforced plastic hull
25 Galley
26 Officers' mess
27 Radio room
28 Central control
29 Engine room control
30 Engineers' mess
31 Fuel
32 Crew's mess
33 Ladder
34 Foremast
35 Navigation radar
36 Main navigation light
37 Bridge
38 Sonar room
39 20-mm gun
40 Crew
41 Ammunition hoist
42 Auxiliary machine room
43 Magazine
44 Sonar tube
45 Sonar DUBM 21A
46 Active tank stabilizer
47 Bow thrusters
48 Waterline
49 Deck winch/anchor housing
50 Inflatable dinghy

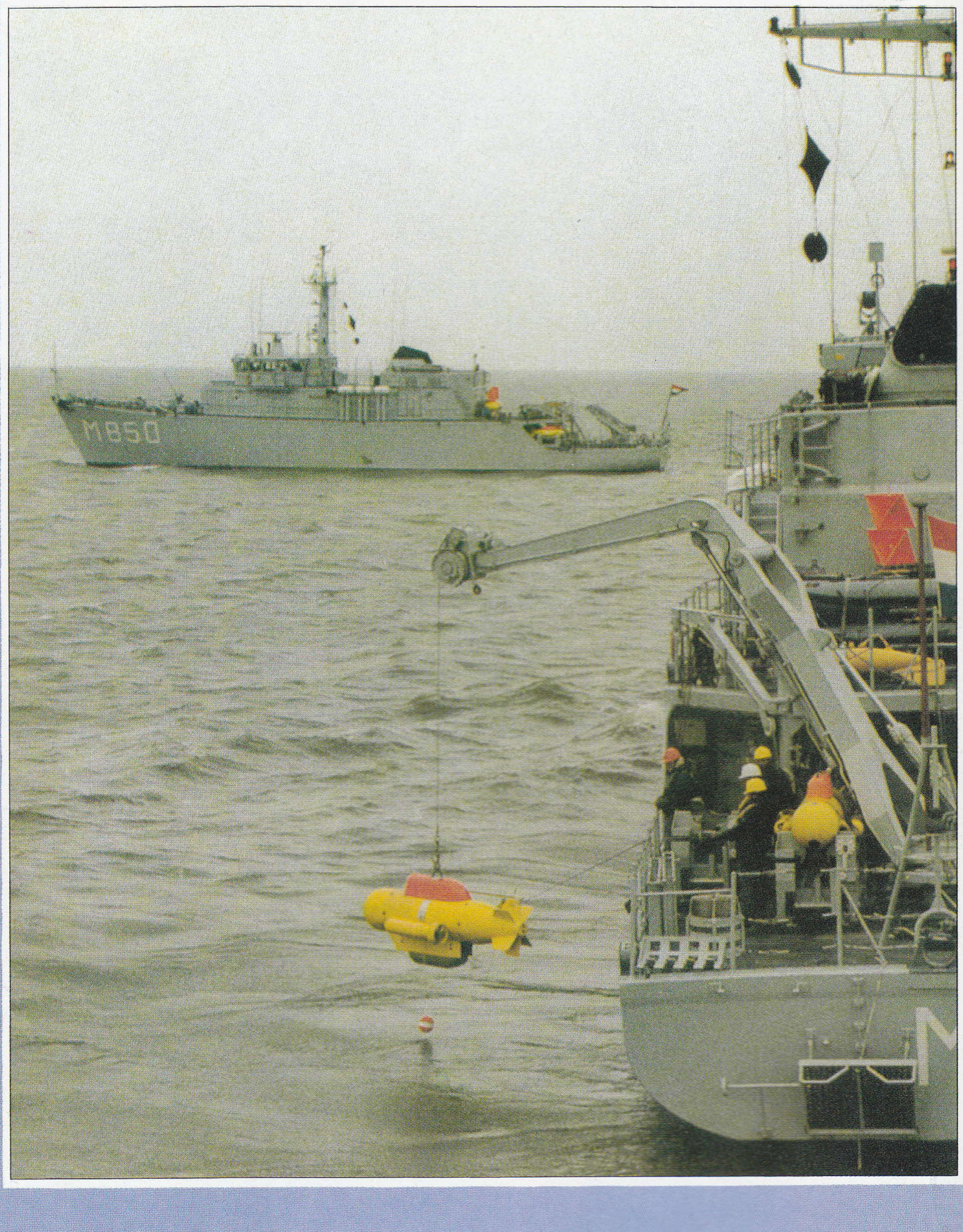




Above: Fifth of the Dutch 'Alkmaar' class is the Haarlingen. *All the Tripartite class are fitted with French DUBM-21A minehunting sonar and two PAP-104 remote controlled mine disposal vehicles which carry high explosive charges.*

Right: The Alkmaar *and one of her sister ships are seen on an exercise. The latter is lowering one of her PAP-104 mine disposal vehicles over the side by hydraulic crane; guided by a cable link to the suspect mine, it can deposit the explosive charge beneath its belly as directed by its operator.*

Below: The Eridan, *with a maximum speed of 15 kts, could take days to reach an operational area. This is one of the penalties that modern mine countermeasures vessels have to put up with, because large propulsion plants for high speeds cause excessive magnetic signatures.*



EAST GERMANY

'Kondor II' class

Classified as high-seas minesweepers by the East German navy, the **'Kondor II' class** units were built between 1971 and 1978 at the Peenewerft shipyard, Wolgast to replace the obsolete 'Habicht' and 'Krake' classes of minesweepers/minelayers. Twenty-four units (pennant numbers 311-316, 321-326, 331-336 and 341-346) currently serve in the minesweeping role, and several are now fitted with a large deckhouse abaft the main towed sweep reel for what may be a minehunting operations centre. A further three (pennant numbers S321-323) are in use as training ships with the Walter Steffens Naval School, whilst another three (pennant numbers V381-383) serve as trials ships to test new minesweeping techniques and equipment. A further unit was extensively modified in 1978 to serve as the hydrographic survey ship ***Karl Friedrich Gauss*** (D24), and the last unit was modified after launching with an enlarged superstructure to act as the state yacht ***Ostseeland 1*** (H04). Nineteen of the earlier **'Kondor I' class** vessels, which were classed as coastal minesweepers, have been transferred to the Grenze Brigade Kuste (GBK, or coastal border guard) as patrol boats. However, they have retained their sweeping gear and would revert to the minesweeper role on the outbreak of hostilities. It seems that the 'Kondor II' class is equipped for moored, acoustic and magnetic minesweeping.

Specification

'Kondor II' class

Displacement: 310 tons standard and 400 tons full load

Dimensions: length 55.0 m (180.4 ft); beam 7.0 m (23.0 ft); draught 2.0 m (6.6 ft)

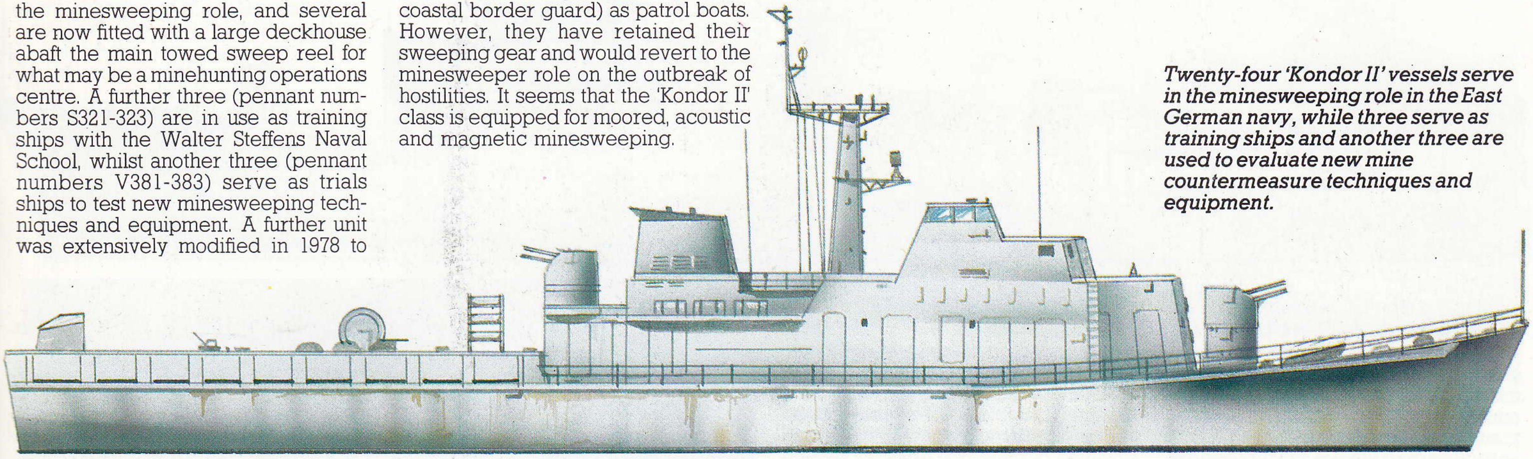
Propulsion: two diesels delivering 2983 kW (4,000 hp) to two shafts

Speed: 21 kts

Armament: two or three twin 25-mm AA guns

Electronics: one TSR33 navigation radar, and several precision radio and sonar systems

Complement: 40



Twenty-four 'Kondor II' vessels serve in the minesweeping role in the East German navy, while three serve as training ships and another three are used to evaluate new mine countermeasure techniques and equipment.

USSR

'Vanya I' and 'Vanya II' classes

In series production from 1961 to 1973, the wooden-hulled **'Vanya I' class** was designated a *bazory tralschchik* (BT, or base minesweeper) design which could also double as a minehunter. A total of 69 'Vanya I' units remain in service with the Soviet navy, while four others were transferred to the Bulgarian navy and two to the Syrian navy in the early 1970s. One other unit was converted in 1974 to a pure minehunter configuration for research and development purposes, with its superstructure extended forward, a twin 25-mm AA gun added in place of the normal 30-mm mount, together with a lattice mast with 'Don Kay' navigation radar at the amidships break point and two boats for divers on the quarterdeck.

Two others have since been built to the **'Vanya II' class** design with an additional 1-m (3.3-ft) hull extension, a more extensive fantail work area and heavier davits aft, a 'Don Kay' navigation radar in place of the 'Don 2' system, and a larger diesel generator exhaust pipe amidships. This subvariant is used as the guidance ships for the unmanned 'Ilyusha' class of radio-controlled inshore minesweeper drones. The 'Ilyushas' displace some 85 tons full load and are 26.4 m (86.6 ft) long. They are believed to carry both normal sweep gear and a linear explosive mine-disposal system for laying over the stern. For transit purposes they carry a crew of 10. Each 'Vanya II' can control up to three 'Ilyushas' during a sweep operation.

Specification

'Vanya' classes

Displacement: 200 tons standard and 245 tons ('Vanya I') or 260 tons ('Vanya II') full load

Dimensions: length 40.0 m (131.2 ft) for 'Vanya I' or 41.0 m (134.5 ft) for 'Vanya II'; beam 7.3 m (24.0 ft); draught 1.8 m (5.9 ft)

Propulsion: two diesels delivering 1641 kW (2,200 hp) to two shafts

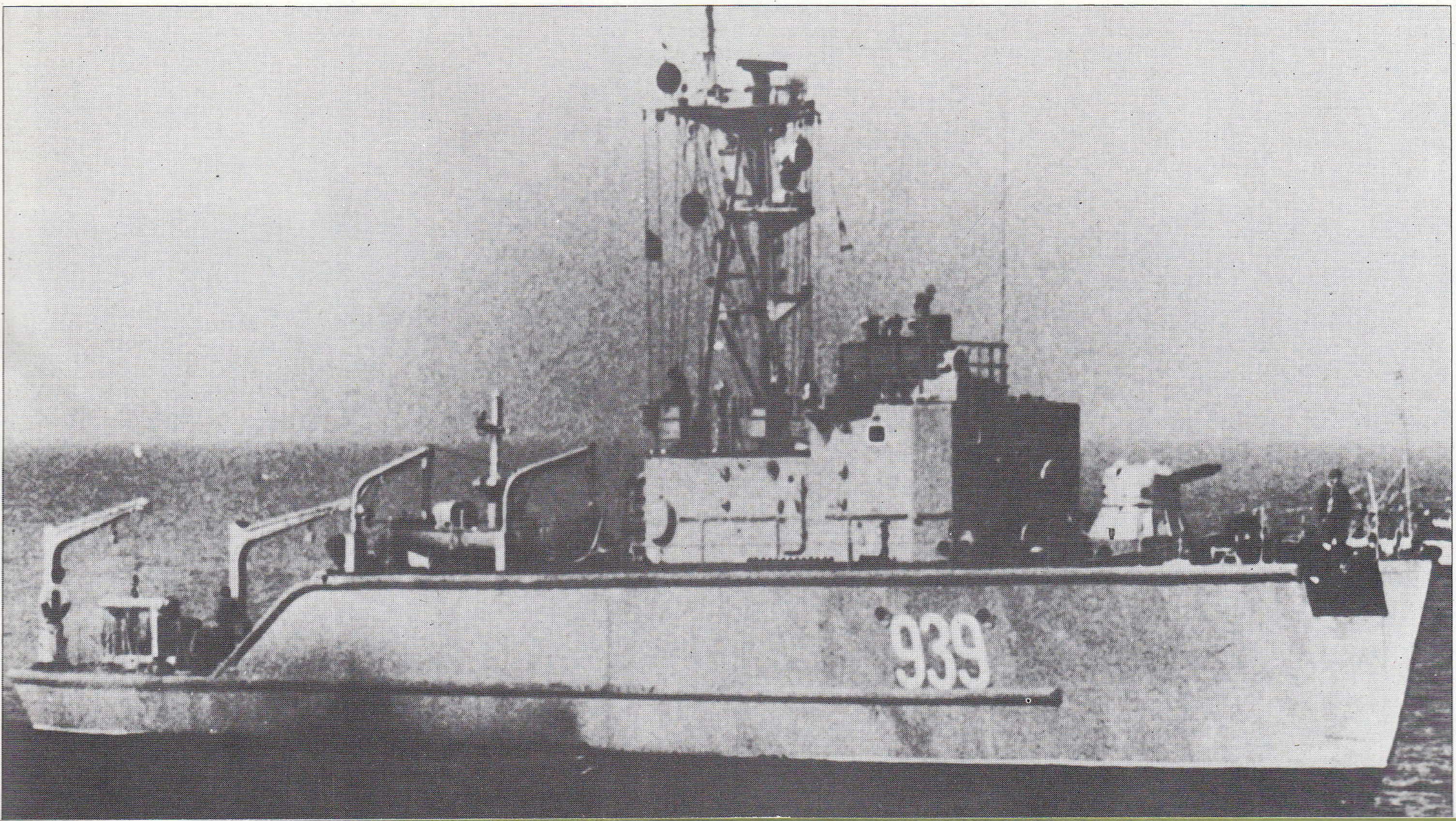
Speed: 16 kts

Armament: one twin 30-mm AA gun, and between eight and 16 mines depending on type

Electronics: one 'Don 2' navigation radar, one 'Dead Duck' IFF, one 'High Pole-B' IFF, and one minehunting sonar

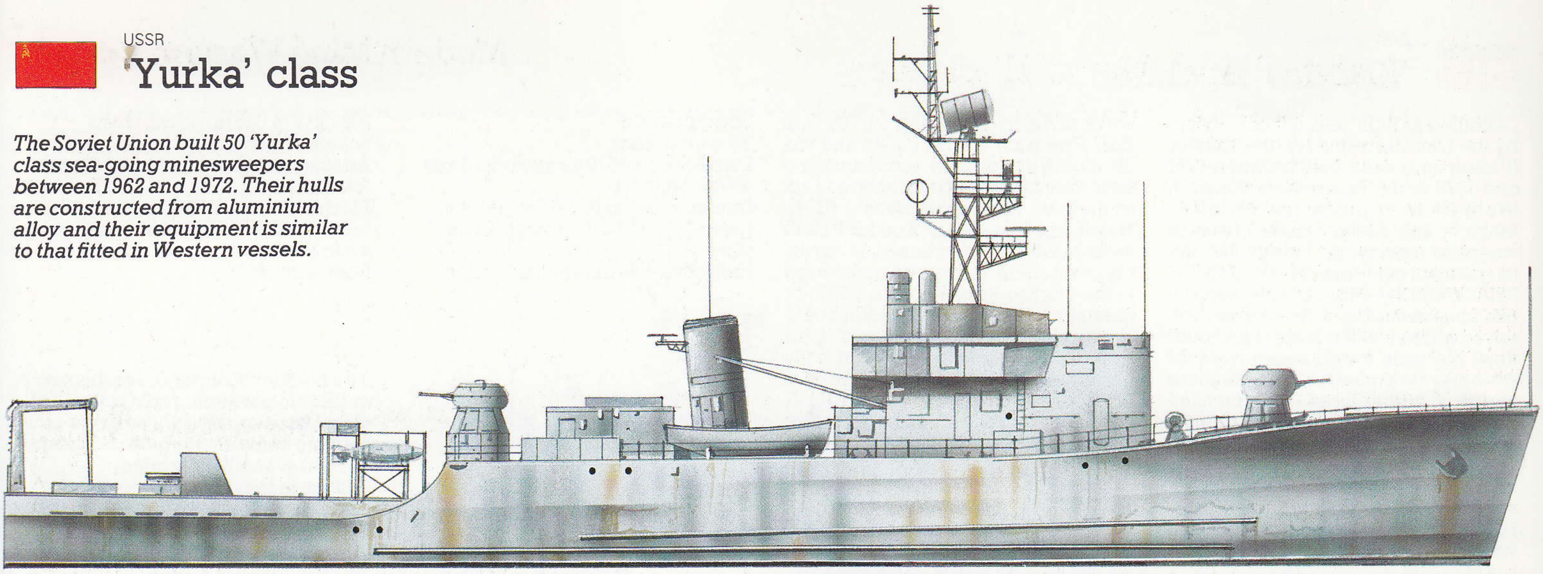
Complement: 30

Designated a **Bazory Tralshchik** *(base minesweeper) by the Soviets, the 'Vanya' class was in series construction from the early 1960s to the early 1970s. It is currently the most numerous of the coastal minesweeper forces, with 69 'Vanya' and three 'Vanya Mods' in service in mid-1985.*



USSR

'Yurka' class



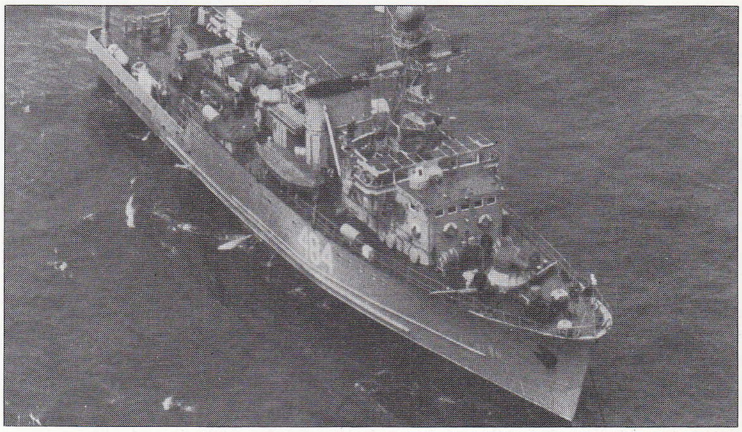
The Soviet Union built 50 'Yurka' class sea-going minesweepers between 1962 and 1972. Their hulls are constructed from aluminium alloy and their equipment is similar to that fitted in Western vessels.

Built from 1963 to 1972, the aluminium alloy hull **'Yurka' class** was the smaller predecessor to the Natya design but without the latter's ASW weapons and stern ramp. Similarly designated *morskoy tralschchik* (MT, or seagoing minesweeper), the 'Yurkas' are fitted to sweep acoustic and magnetic mines only, with gear similar to that used by the West. A total of 50 units was completed, of which 45 standard units still serve in the Soviet navy, one other ex-Soviet unit being transferred to the Vietnamese navy in 1979. The remaining four were constructed to a more austere export configuration in the late 1960s for the Egyptian navy: they have no fire-control radar, and additional ship's side scuttles are provided for better air flow beneath decks for service in hot climates.

The broad funnel indicates that the diesel engines are in a side-by-side arrangement below decks, and aids the distinguishability from the 'Natyas'. Several units have now been retrofitted with the standard light forces AA armament update package of two quadruple SA-N-5 'Grail' SAM launchers with reloads. The class also continues the Soviet tradition of fitting its MCM units with mine rails for defensive purposes in coastal and deep-sea anchorages. The minehunting sonar is a variant of the surface ship and submarine 'Tamir' high-frequency active set, modified to allow short-range classification of mine-like objects.

Specification

'Yurka' class
Displacement: 460 tons standard and 540 tons full load
Dimensions: length 52.0 m (170.6 ft); beam 8.8 m (28.9 ft); draught 2.6 m (8.5 ft)
Propulsion: two diesels delivering 4,000 hp (2983 kW) to two shafts
Speed: 19 kts
Armament: two twin 30-mm AA guns, and between 10 and 20 mines depending on type
Electronics: one 'Don 2' navigation radar, one 'Drum Tilt' AA fire-control radar, two 'Square Head' IFF, one 'High Pole-B' IFF, and one 'Tamir' minehunting sonar
Complement: 45-50

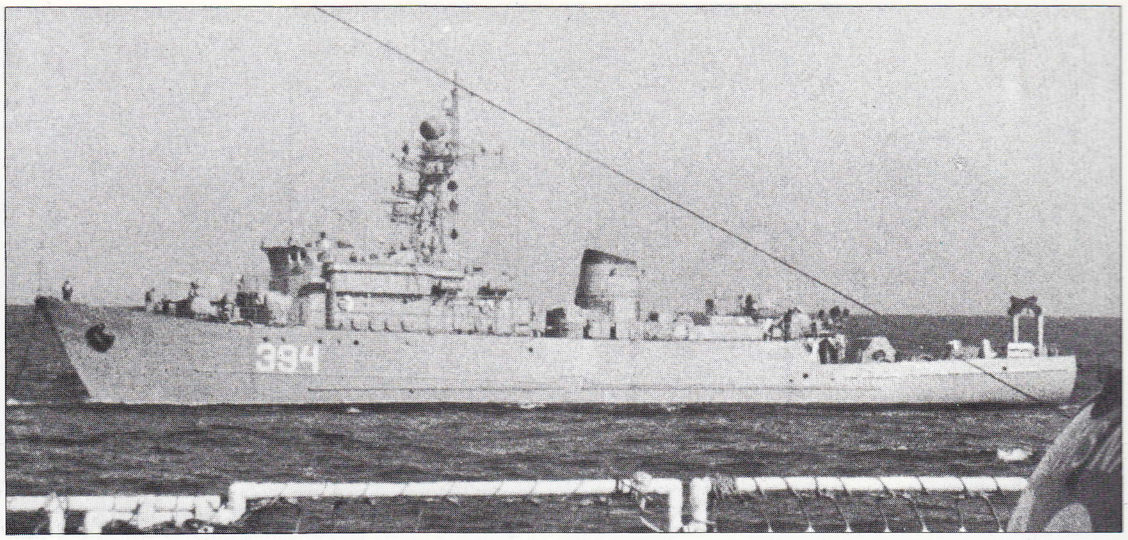


Above: The aluminium alloy-hulled 'Yurka' class of sea-going minesweepers is fitted for magnetic and acoustic sweeping operations. To improve their self-defence capabilities the class is currently being refitted with SA-N-5 Grail SAM launchers.

Below: The 'Yurka' classes' 'Drum Tilt' fire control radar is carried at the top of the mainmast above the IFF systems and the 'Don 2' navigation radar. Surprisingly for ocean-going minesweepers, this class does not have any ASW systems, which are fitted to earlier and later classes.

USSR

'Natya I' and 'Natya II' classes



'Natya I' class seagoing minesweepers occasionally double as intelligence gatherers if no specifically dedicated vessels are available. Here a 'Natya I' monitors the operations of the 'Leander' class frigate HMS **Naiad.**

First reported in 1971, the aluminium-hulled **'Natya I' class** is designated a *morskoy tralshchik* (MT, or seagoing minesweeper) by the Soviets and is the follow-on to the 'Yurka' design. The earliest units of the 34 Soviet navy 'Natya Is' built at Izhora and Khabarovsk in the period 1969-80 were fitted with two rigid davits aft, an arrangement changed in the later craft to articulated hydraulically operated davits to handle the sweep gear and towed MCM bodies over the stern ramp. The 'Natya Is' are also equipped with two five-barrel RBU1200 ASW rocket-launchers to facilitate the use of the class members as coastal ASW escorts. In addition most units have now been fitted with two quadruple SA-N-5 'Grail' SAM systems just abaft the lattice mast, while others have had a second navigation radar added atop the pilothouse.

In 1980 a single **'Natya II' class** variant was completed with a lengthened superstructure and the transom cut away amidships to take a 1.5-m (5-ft) sheath. This is believed to be a research and development minehunting vessel.

The 'Natya I' is still being produced in small quantities for the export market in a slightly less well equipped version. Some 12 have been built to date for India (six between 1978-80) and Libya (six between 1981-4), with possibly more to come for India. The Soviets operate their units mainly in home waters, but the vessels have also been seen in the Mediterranean and Indian Ocean, and off West Africa.

Specification

'Natya' classes

Displacement: 650 tons standard and 765 tons full load

Dimensions: length 61.0 m (200.1 ft); beam 10.0 m (32.8 ft); draught 3.5 m (11.5 ft)

Propulsion: two diesels delivering 3729 kW (5,000 hp) to two shafts

Speed: 18 kts

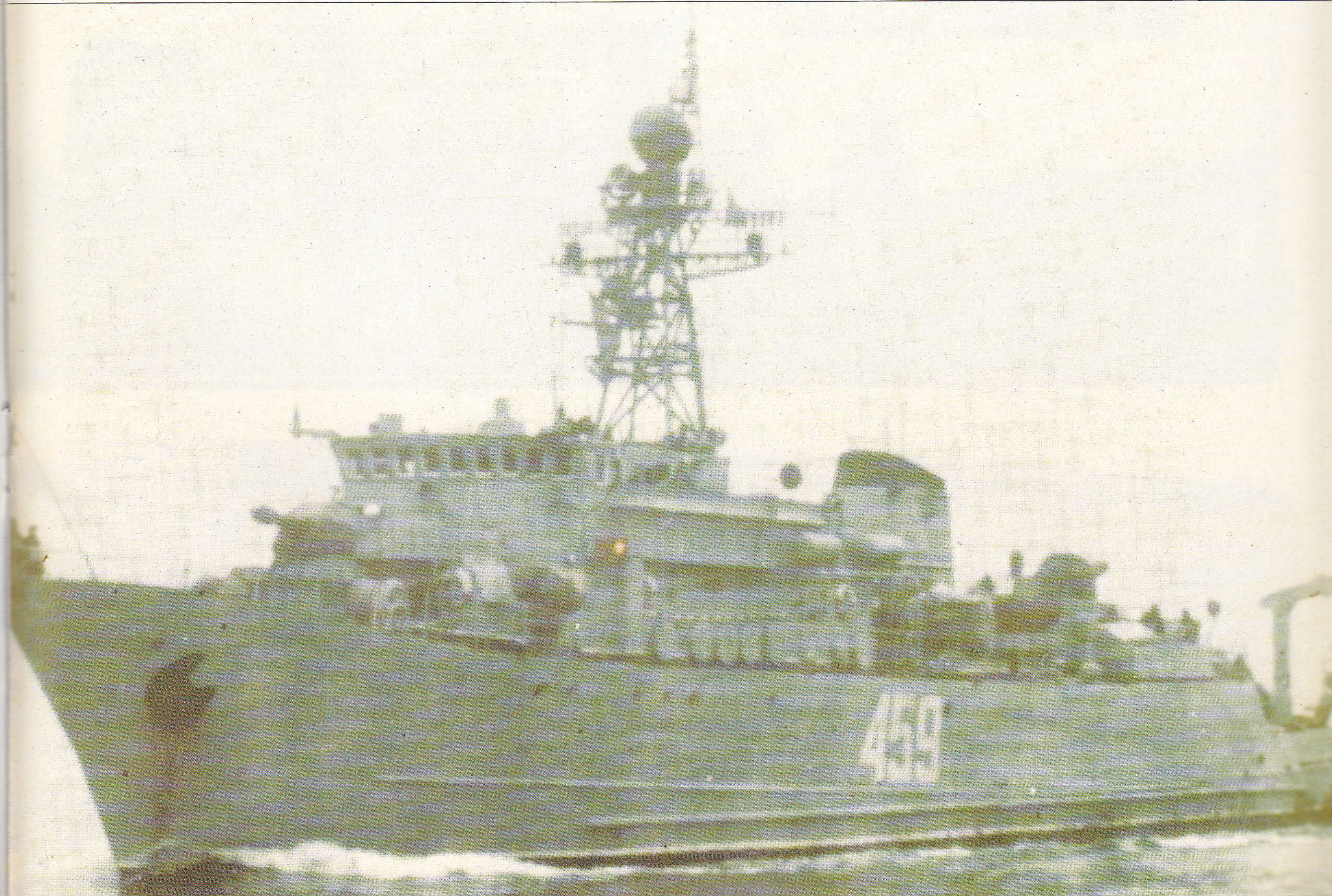
Armament: ('Natya I') in most units two quadruple SA-N-5 'Grail' SAM launchers with 16 missiles, two twin 30-mm AA and two twin 25-mm AA guns, two 250-mm (9.84-in) five-barrel RBU1200 ASW rocket-launchers with 50 rockets, and between 10 and 20 mines depending on type

Armament: ('Natya II') two quadruple SA-N-5 'Grail' SAM launchers with 16 missiles, and two twin 30-mm AA guns

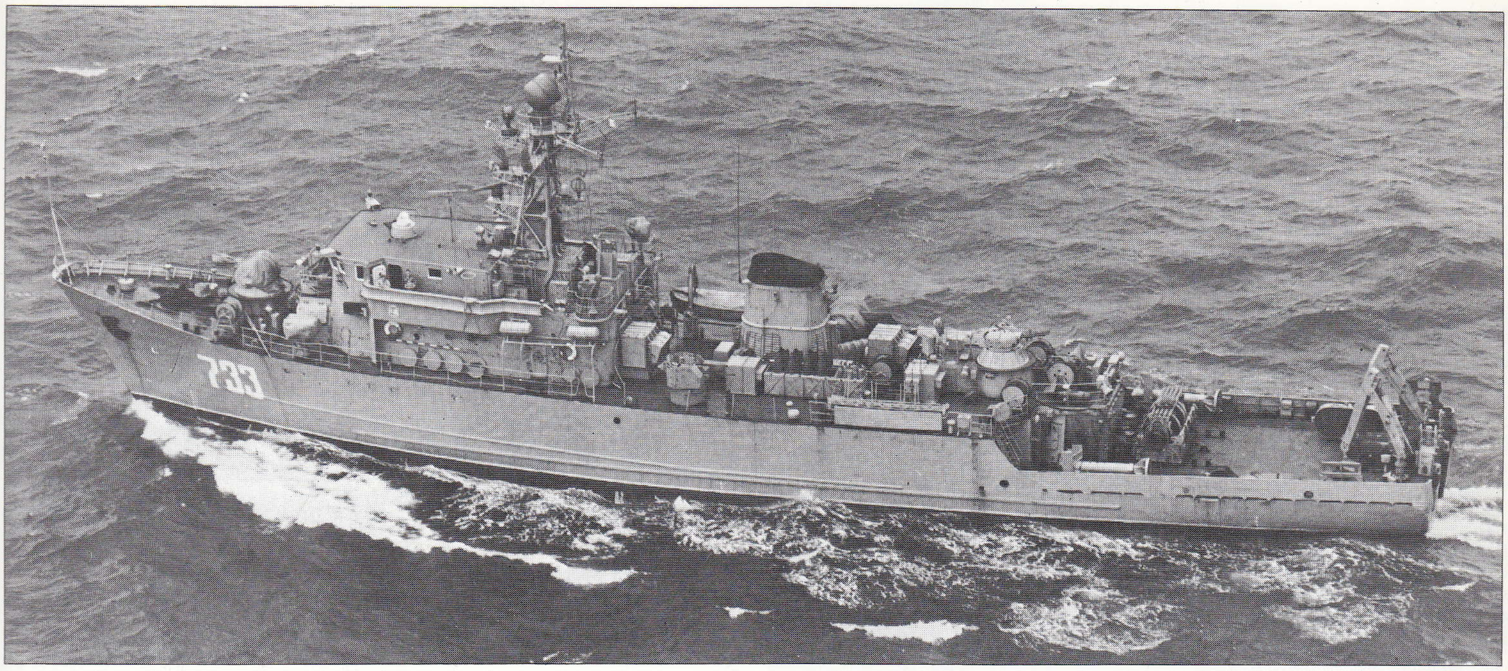
Electronics: one or two 'Don 2' navigation radars, one 'Drum Tilt' AA fire-control radar, two 'Square Head' IFF, one 'High Pole-B' IFF, and one 'Tamir' minehunting sonar

Complement: 60

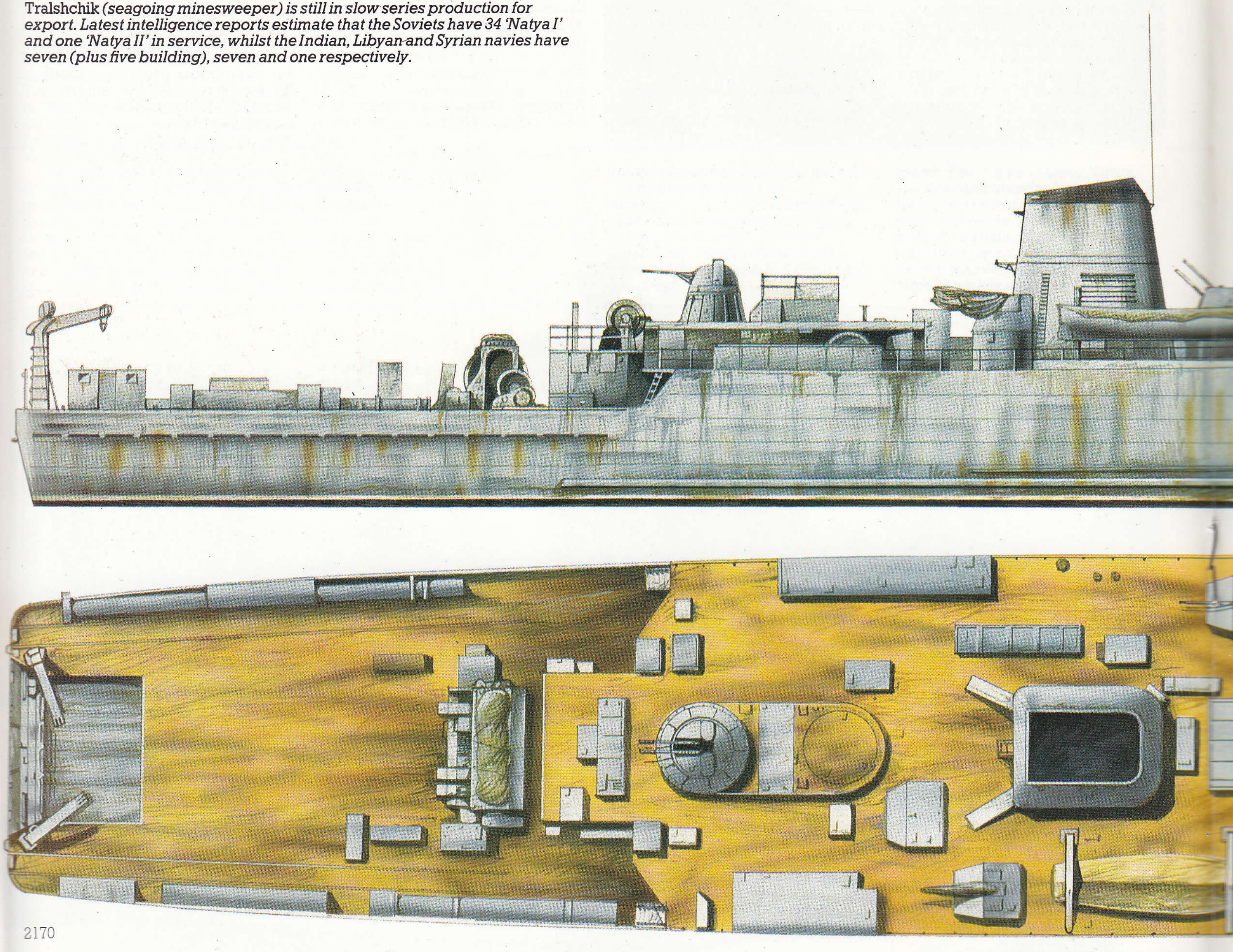
The 'Natya I' usually operates in home waters, but on occasions vessels of this type have been deployed to the Mediterranean, Indian Ocean and West Africa, where in wartime their ASW armament of rocket launchers could come in handy for limited escort duties.



'Natya' Class Seagoing Minesweepe



Built as a successor to the 'Yurka' class the 'Natya I' design of Morskoy Tralshchik (seagoing minesweeper) is still in slow series production for export. Latest intelligence reports estimate that the Soviets have 34 'Natya I' and one 'Natya II' in service, whilst the Indian, Libyan and Syrian navies have seven (plus five building), seven and one respectively.



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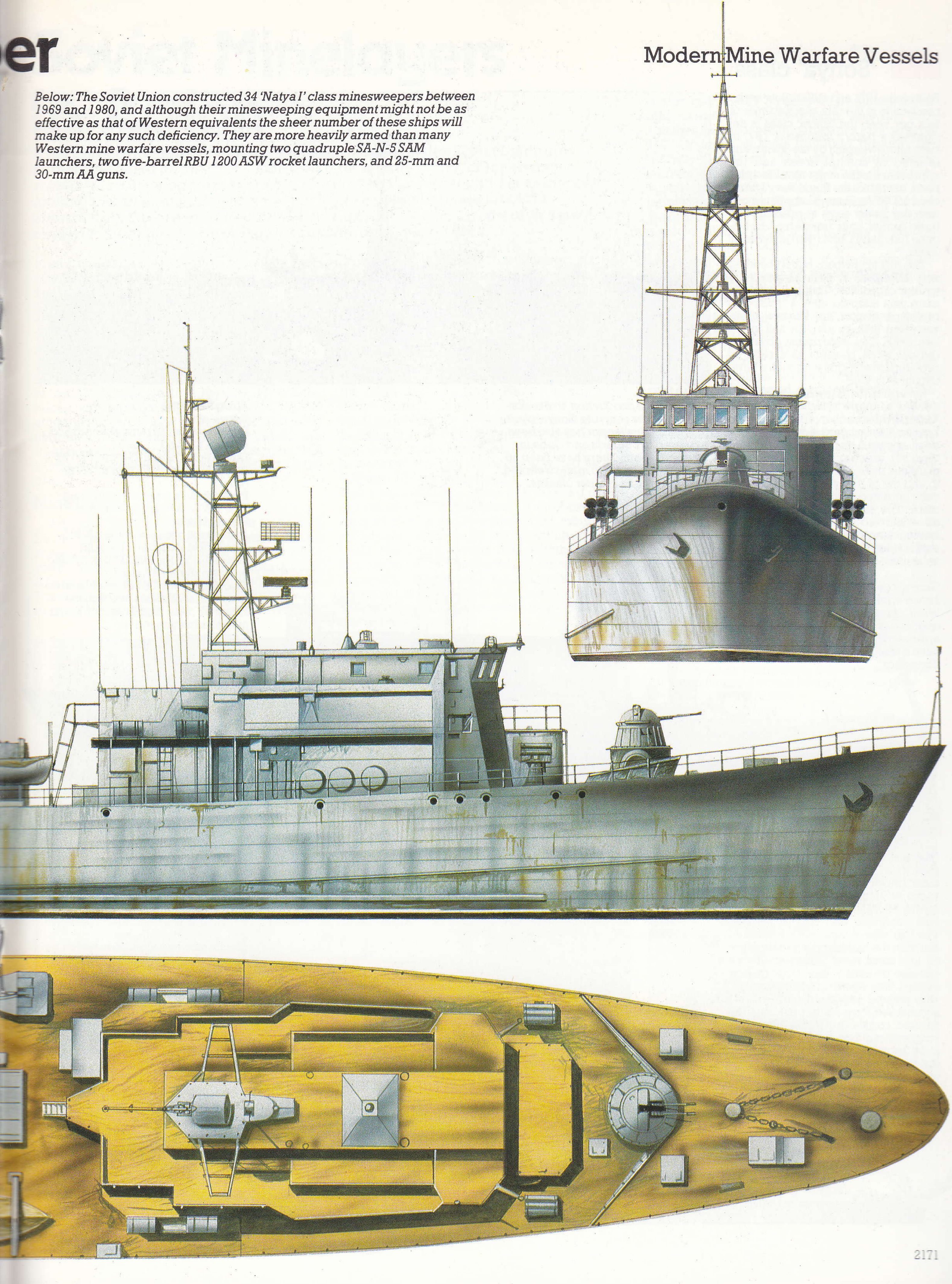
Below: The Soviet Union constructed 34 'Natya I' class minesweepers between 1969 and 1980, and although their minesweeping equipment might not be as effective as that of Western equivalents the sheer number of these ships will make up for any such deficiency. They are more heavily armed than many Western mine warfare vessels, mounting two quadruple SA-N-5 SAM launchers, two five-barrel RBU 1200 ASW rocket launchers, and 25-mm and 30-mm AA guns.



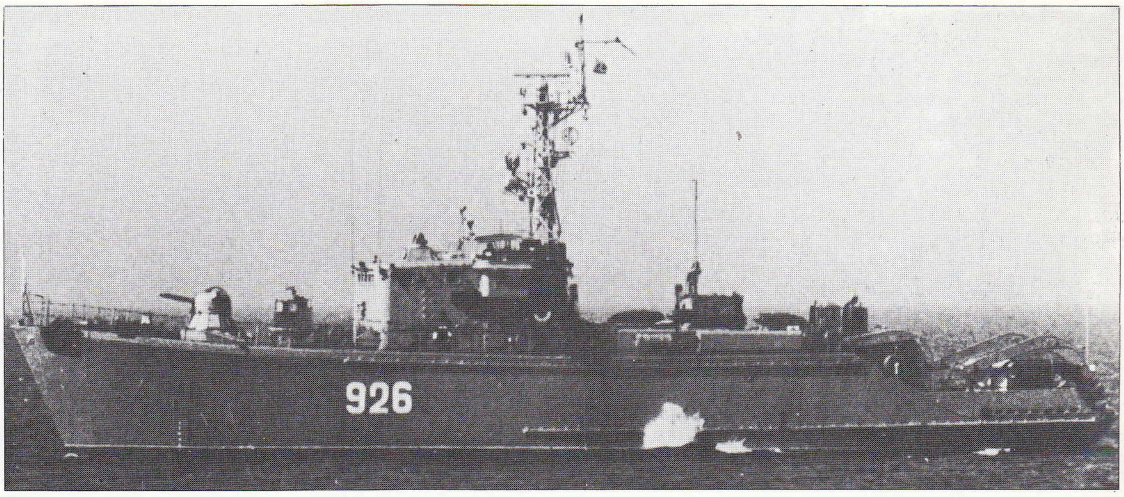
USSR

'Sonya' class

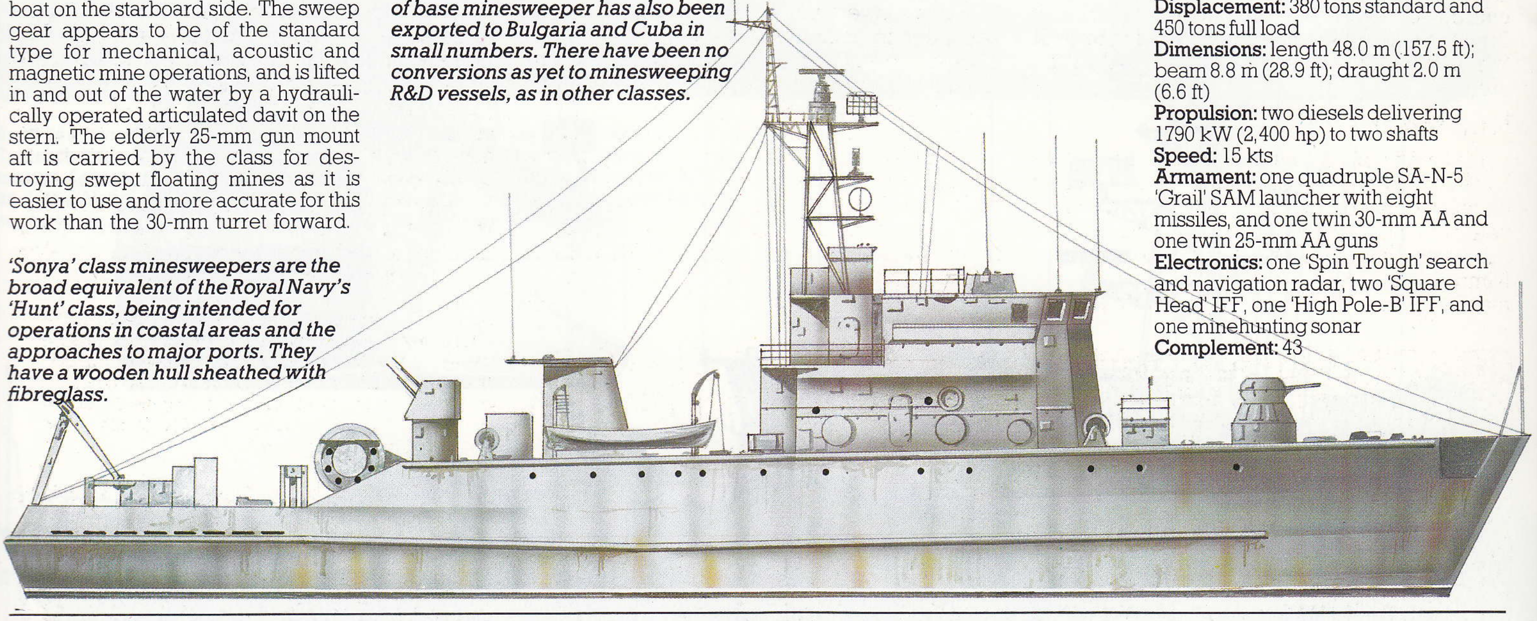
Built since 1972 and still in slow series production at the rate of some three or four per year, the **'Sonya' class** is designated a *bazory tralschchik* (BT, or base minesweeper) by the Soviets and is used in coastal areas and the approaches to the major naval and civil ports, much like the Royal Navy's 'Hunt' class MCMVs. Some 50 are in service with the Soviet navy at present, with three further units transferred to Bulgaria (one) and Cuba (two) in the early 1980s.

The hull is of wood, but is sheathed with fibreglass to prevent attack by marine organisms. This hull arrangement was adopted after a three-ship prototype design, the **'Zhenya' class**, was tried with an all-GRP hull in the late 1960s. The experiment obviously did not work, possibly as a result of problems in working with such a large structure in GRP.

Several of the 'Sonyas' have now received a single quadruple SA-N-5 'Grail' SAM launcher abaft the ship's boat on the starboard side. The sweep gear appears to be of the standard type for mechanical, acoustic and magnetic mine operations, and is lifted in and out of the water by a hydraulically operated articulated davit on the stern. The elderly 25-mm gun mount aft is carried by the class for destroying swept floating mines as it is easier to use and more accurate for this work than the 30-mm turret forward.



Still in series production at three or four units per year, the 'Sonya' class of base minesweeper has also been exported to Bulgaria and Cuba in small numbers. There have been no conversions as yet to minesweeping R&D vessels, as in other classes.



'Sonya' class minesweepers are the broad equivalent of the Royal Navy's 'Hunt' class, being intended for operations in coastal areas and the approaches to major ports. They have a wooden hull sheathed with fibreglass.

Specification
'Sonya' class
Displacement: 380 tons standard and 450 tons full load
Dimensions: length 48.0 m (157.5 ft); beam 8.8 m (28.9 ft); draught 2.0 m (6.6 ft)
Propulsion: two diesels delivering 1790 kW (2,400 hp) to two shafts
Speed: 15 kts
Armament: one quadruple SA-N-5 'Grail' SAM launcher with eight missiles, and one twin 30-mm AA and one twin 25-mm AA guns
Electronics: one 'Spin Trough' search and navigation radar, two 'Square Head' IFF, one 'High Pole-B' IFF, and one minehunting sonar
Complement: 43

USSR

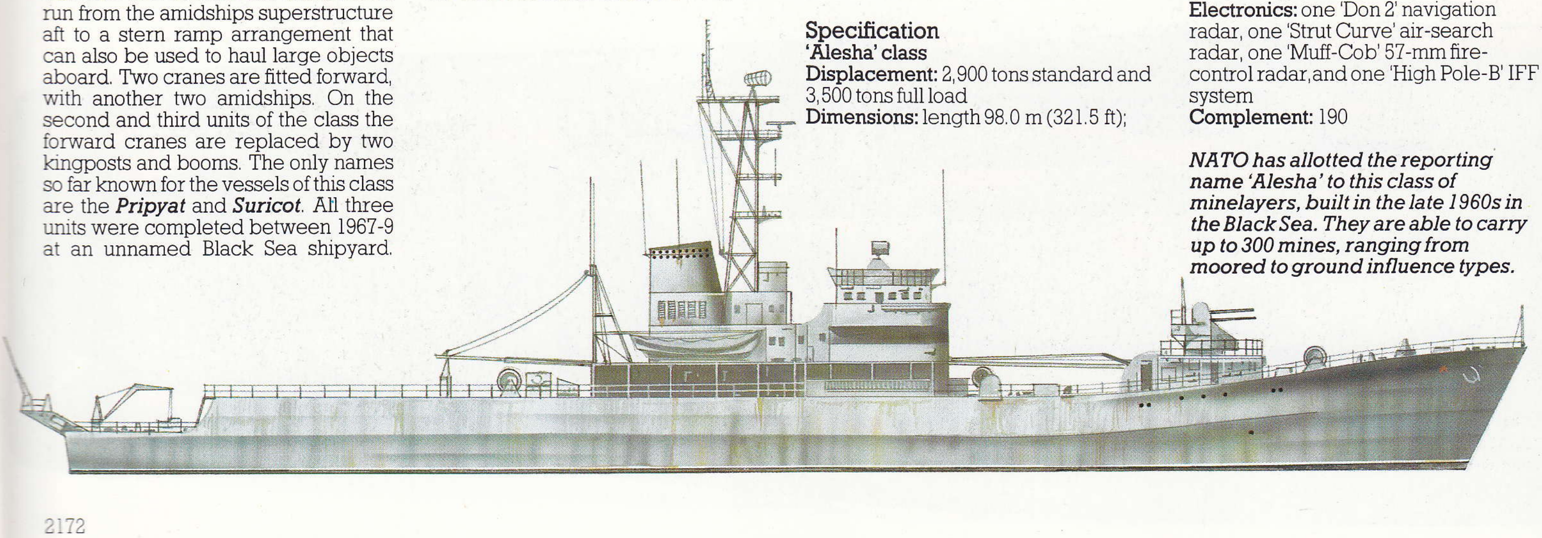
'Alesha' class

Designated *zagraditel' minnyy* (ZM, or minelayer) by the Soviets, the **'Alesha' class** (a NATO reporting name) can serve as minelayers, defensive netlayers, MCMV tenders and mine warfare command and control centres. The four sets of mine rail tracks fitted run from the amidships superstructure aft to a stern ramp arrangement that can also be used to haul large objects aboard. Two cranes are fitted forward, with another two amidships. On the second and third units of the class the forward cranes are replaced by two kingposts and booms. The only names so far known for the vessels of this class are the ***Pripyat*** and ***Suricot***. All three units were completed between 1967-9 at an unnamed Black Sea shipyard.

The number of mines carried varies up to a maximum of 300 according to type, but it is known that apart from the conventional moored buoyant types such as the M08 contact and the KRAB influence mines the 'Aleshas' can also lay the MZ26 moored contact sweep obstructor and the AMD-500 and AMD-1000 ground influence mines. The main minelaying effort of the Soviet navy is concentrated into its bomber and maritime patrol aircraft, surface ships and conventional submarine fleet.

Specification
'Alesha' class
Displacement: 2,900 tons standard and 3,500 tons full load
Dimensions: length 98.0 m (321.5 ft); beam 13.5 m (44.3 ft); draught 5.4 m (17.7 ft)
Propulsion: four diesels delivering 5966 kW (8,000 hp) to two shafts
Speed: 17 kts
Armament: one quadruple 57-mm AA gun, and up to 300 mines
Electronics: one 'Don 2' navigation radar, one 'Strut Curve' air-search radar, one 'Muff-Cob' 57-mm fire-control radar, and one 'High Pole-B' IFF system
Complement: 190

NATO has allotted the reporting name 'Alesha' to this class of minelayers, built in the late 1960s in the Black Sea. They are able to carry up to 300 mines, ranging from moored to ground influence types.



Soviet Minelayers in Action

If the United Kingdom should ever find itself at war with the Soviet Union the submarine bases on the river Clyde would be a prime target for the enemy minelayers. Dropped from aircraft or released by submarines and even innocent-looking merchantmen, Soviet mines could pose a serious threat to NATO submarines; the already under-strength British minehunter force would have to deal with the mines, but in doing so would become a target itself.

In any future war involving NATO and the Warsaw Pact the major British and US nuclear submarine bases on the River Clyde will be a prime target for covert Soviet minelaying activities. The obvious platforms for the laying of these fields will be conventional submarines, and in the immediate pre-war period 'innocent' Soviet and Eastern European merchant ships, fish factory vessels and trawlers which regularly visit Scotland's western regions. Where the mines will be laid will be governed by the actual shipping routes in the Clyde and what information has been gleaned by the Soviets from the years they have spent in using an AGI to monitor submarine traffic in and out of the area.

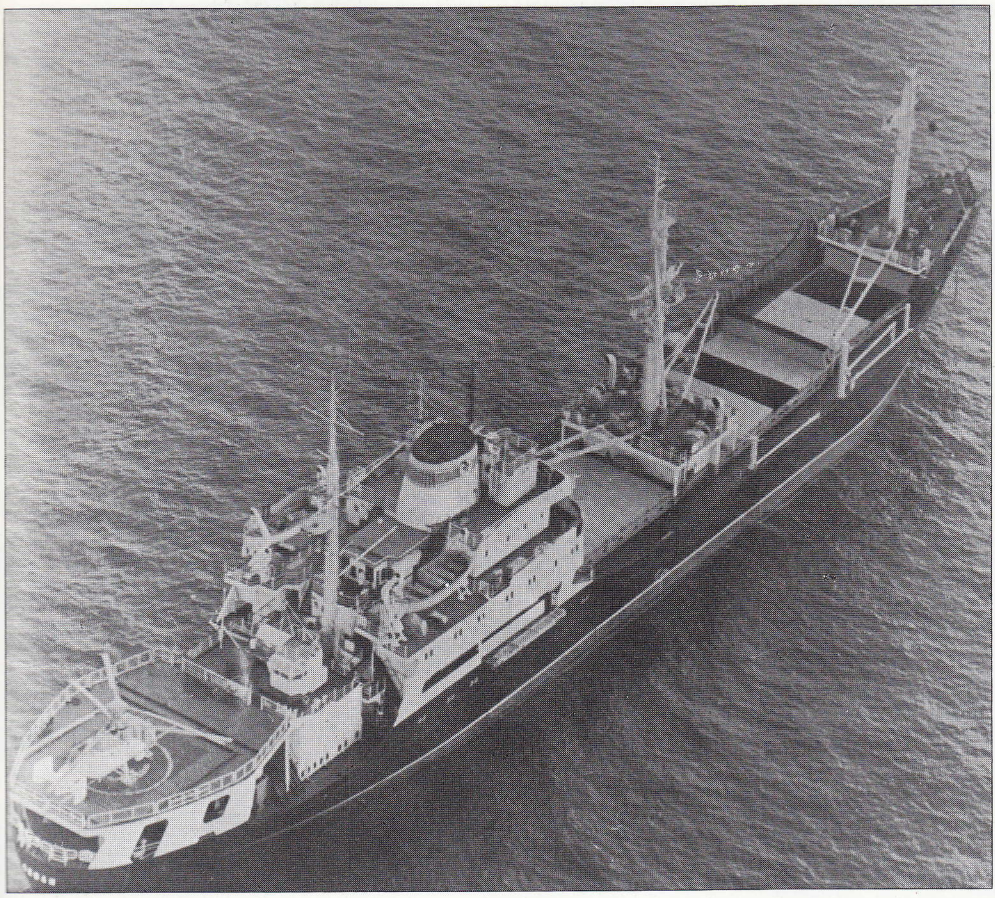
Mine threat

Although nothing official has ever been said by the Ministry of Defence, the threat of mining is real. On one occasion at least in the past few years the masts of a Soviet 'Victor' class nuclear submarine have been photographed by a BAe Nimrod maritime patrol aircraft as the submarine penetrated into the sensitive area around Malins Head and the Clyde estuary on a submerged reconnaissance run. This was almost certainly not the first time that the Soviets had attempted such a mission, and the information gained during these occasions is clearly invaluable in planning covert penetrations into the Clyde to lay ground mines.

To carry out a task of this nature the most likely submarine would be a 'Foxtrot'. Roughly the equivalent of a Royal Navy 'Oberon' class conventional submarine, the 'Foxtrot' would be used in preference to the bigger nuclear types because it is very much quieter and more manoeuvrable in shallow coastal waters. The typical weapons load for this mission would be four 533-mm (21-in) torpedoes in the stern tubes and a full load of 40 AMD-1000 1000-kg (2,205-lb) influence ground mines for the bow tubes. Laid in clusters of four or five all around the mouth and at strategic points within the river itself, the mines would cause immeasurable trouble to the defending MCM forces. Thus to ensure the safety of any transitting SSN or SSBN trying to get home or to start a war patrol, the local naval commander would have to have the routes continually monitored by minehunters and swept by minesweepers, and the submarines themselves accompanied by several MCMV units as they travelled through the highest-risk areas. The size of these areas would be greatly increased if any of the previously mentioned merchant ship types had passed through the Clyde immediately before war broke out, because they would have almost certainly laid a small number of ground mines at random along their route with delay-activation timers, together with a larger number of decoys to confuse the minehunters.

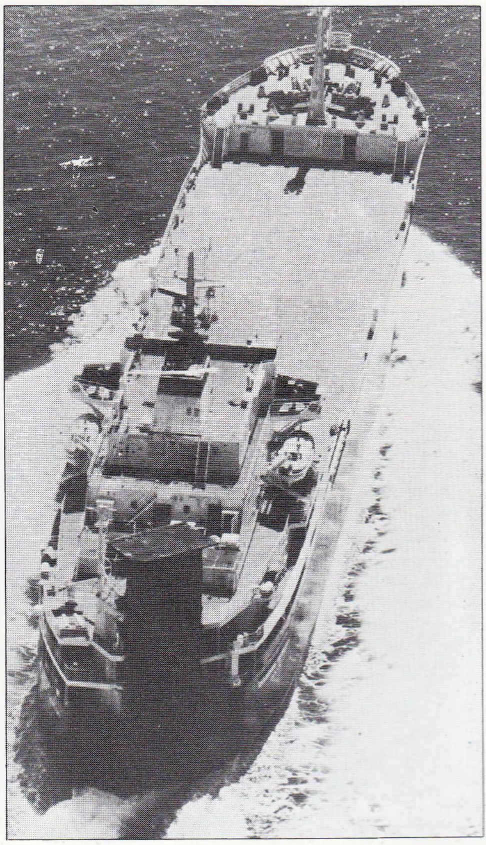
Bombers as minelayers

Further to hinder the MCMVs in their work, the Soviet navy would employ part of its bomber fleet in the minelaying role. Naval Aviation would use Tupolev Tu-16 'Badger' and Tu-26 'Backfire' aircraft as part of a normal nocturnal raid on the military and industrial targets in the area, and then send mine-laden aircraft off to lay their cargoes in the Clyde under cover of the raid and darkness to 'freshen up' the original fields or to create new ones at likely bottlenecks. Such aircraft would probably carry either six to eight of the large AMD-1000 ground mines or 12 to 16 of the smaller 500-kg (1,102-lb) AMD-500 type. The mines could be delivered to the target areas by parachute, or more probably as free-fall weapons with breakaway nose cone and fin assemblies. The latter method is extremely useful as it gives less chance of the mine being spotted by alert coastwatchers during the delivery phase.



One of the Soviet navy's eight 'Vytegrales' class support ships fitted with a helicopter platform aft and carrying a Kamov Ka-25 'Hormone-C' helicopter on it. Fitted with minelaying equipment the vessel could create as much chaos as did the Libyan roll-on/roll-off ferry Ghat *in the Red Sea during 1984.*

Below: The Soviet roll-on/roll-off merchant ship **Akademic Kuprevich** ***could in times of tension be easily converted to carry three or four hundred ground mines for covert laying around NATO coastlines prior to actual war being declared. Her other wartime role would be that of an auxiliary amphibious warfare ship.***

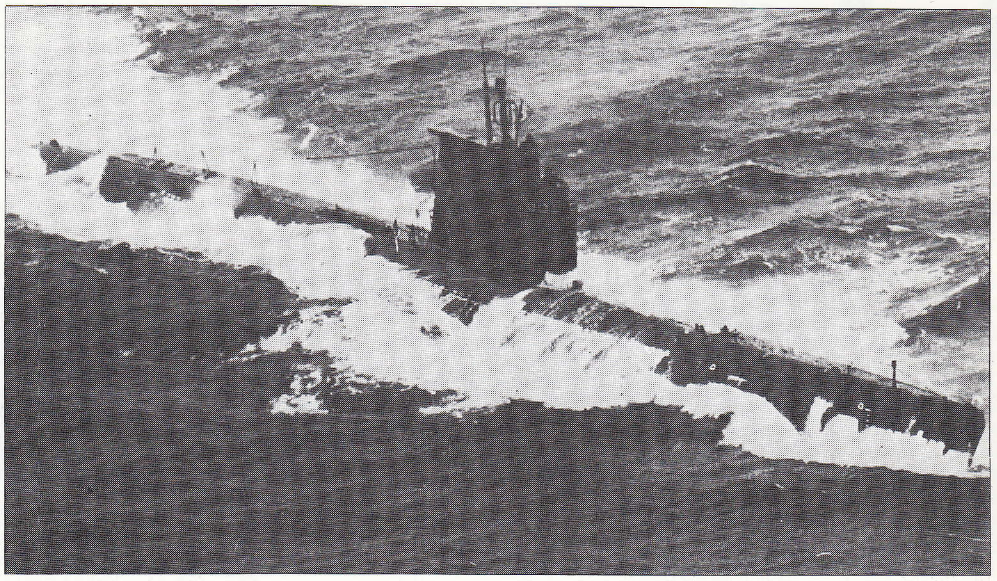


Soviet Minelayers in Action

As the water gets deeper outside the mouth of the Clyde the more difficult it becomes to locate and sweep ground mines. For the AMD-500 the water depth limits are in the order of 4 to 20 m (13 to 66 ft), while for the larger AMD-1000 type the limits are 4 to 55 m (13 to 180 ft). Once past these depths the Soviets could switch to more ASW-orientated mines as the submerged submarine would now be their primary target. Exclusively laid by Soviet nuclear and conventional submarines on the deeper parts of the continental shelf and rise, the bottom-moored rising mine and underwater electrical potential or sectionalized mine are designed at least to disable if not destroy a submarine. With HE charges in the order of 225 kg (496 lb), both types may come in several variants. At least two versions of the rising mine have been identified, the 'Cluster Bay' for use on the shelf itself and the 'Cluster Gulf' for use on the deeper ledge and rise regions. Both are torpedo-shaped devices fitted with a rocket propulsion system and a dual active/passive target detection and verification sonar set. The maximum mooring depth of the two models is said to be about 600 m (1,969 ft).

The underwater electrical potential mine apparently uses the target's own electrical field for detection and trigger purposes, and can be laid in waters as deep as 500 m (1,640 ft).

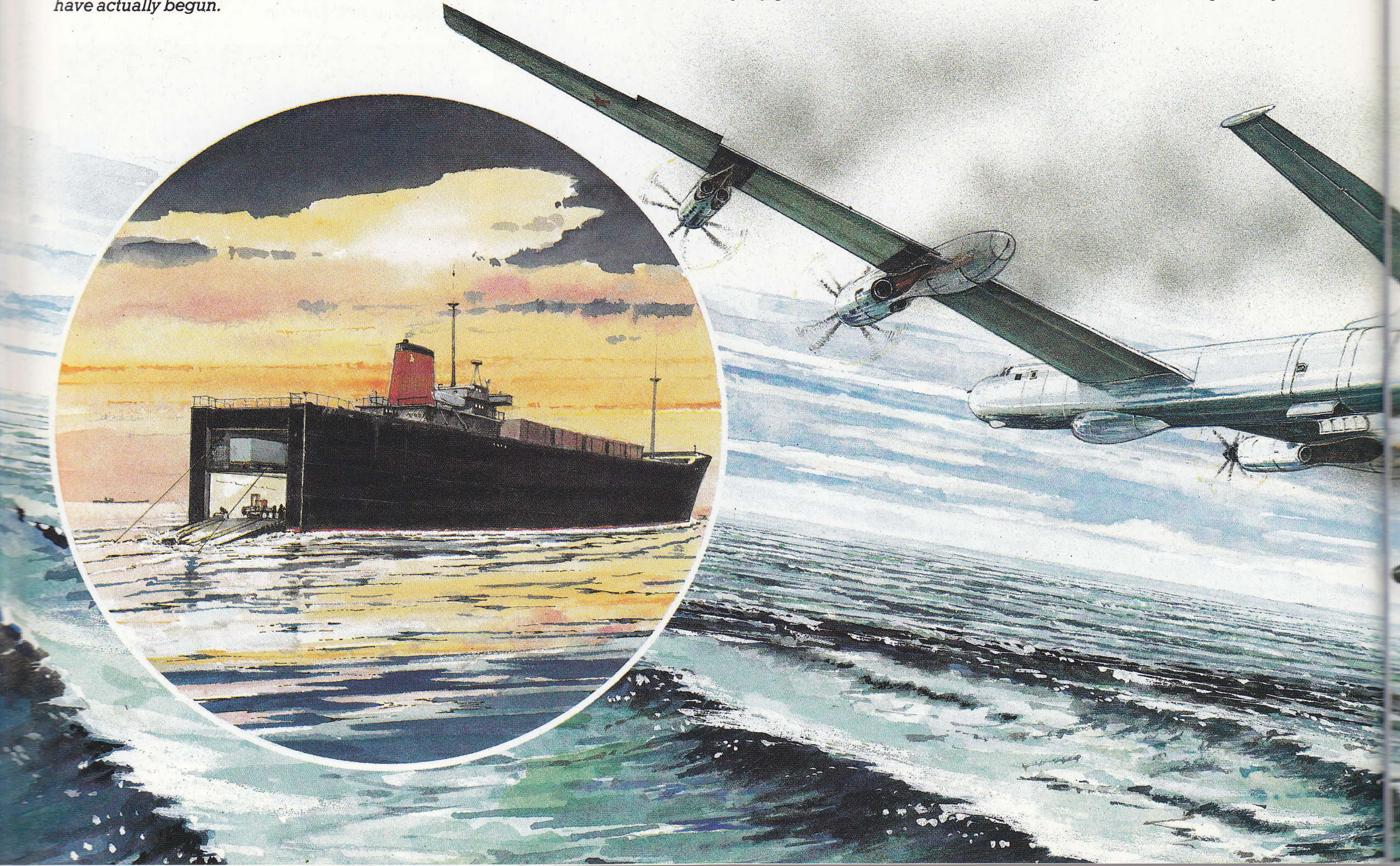
It is the threat posed by these three mines that has resulted in the Royal Navy introducing the deep-sweeping fleet minesweeper into its MCMV force. The likely pattern for laying these mines would be along known or suspected transit routes for submarines entering or leaving the Clyde, where the Soviet vessels themselves could conveniently manoeuvre safely. It is also possible that a Soviet submarine would lay several of these mines in an obvious place in order to entice the fleet minesweepers out as potential torpedo targets. Such a trap would be worthwhile to the Soviets as the numbers of these minesweepers are relatively small; any losses would be of considerable embarrassment to future sweeping operations, even if additional commercial trawlers were commandeered for the same mission. Monitoring the movements of these specialized deep-sweep units would also give valuable indications to just where NATO submarines were travelling, increasing target information for future minelaying patrols.



Although obsolete even by Soviet standards, the few 'Zulu IV' class conventional submarines left in service can carry 36 AMD-1000 ground mines and four torpedoes as a warload. Such submarines will form the main covert laying platform for offensive mine warfare operations, both prior to and during any future conflict.

Thus the Royal Navy's problem in protecting a highly sensitive area such as the Clyde from Soviet minelaying operations in wartime is not easy; it could really be accomplished only by accepting an unavoidably high number of losses amongst the MCM force, which even in peacetime is under strength. When taking into the picture the other tasks around the country that would be assigned to it, especially when

In a future naval war the Soviets can be expected to make full use of their roll-on/roll-off merchant vessels to lay mines, probably before hostilities have actually begun.



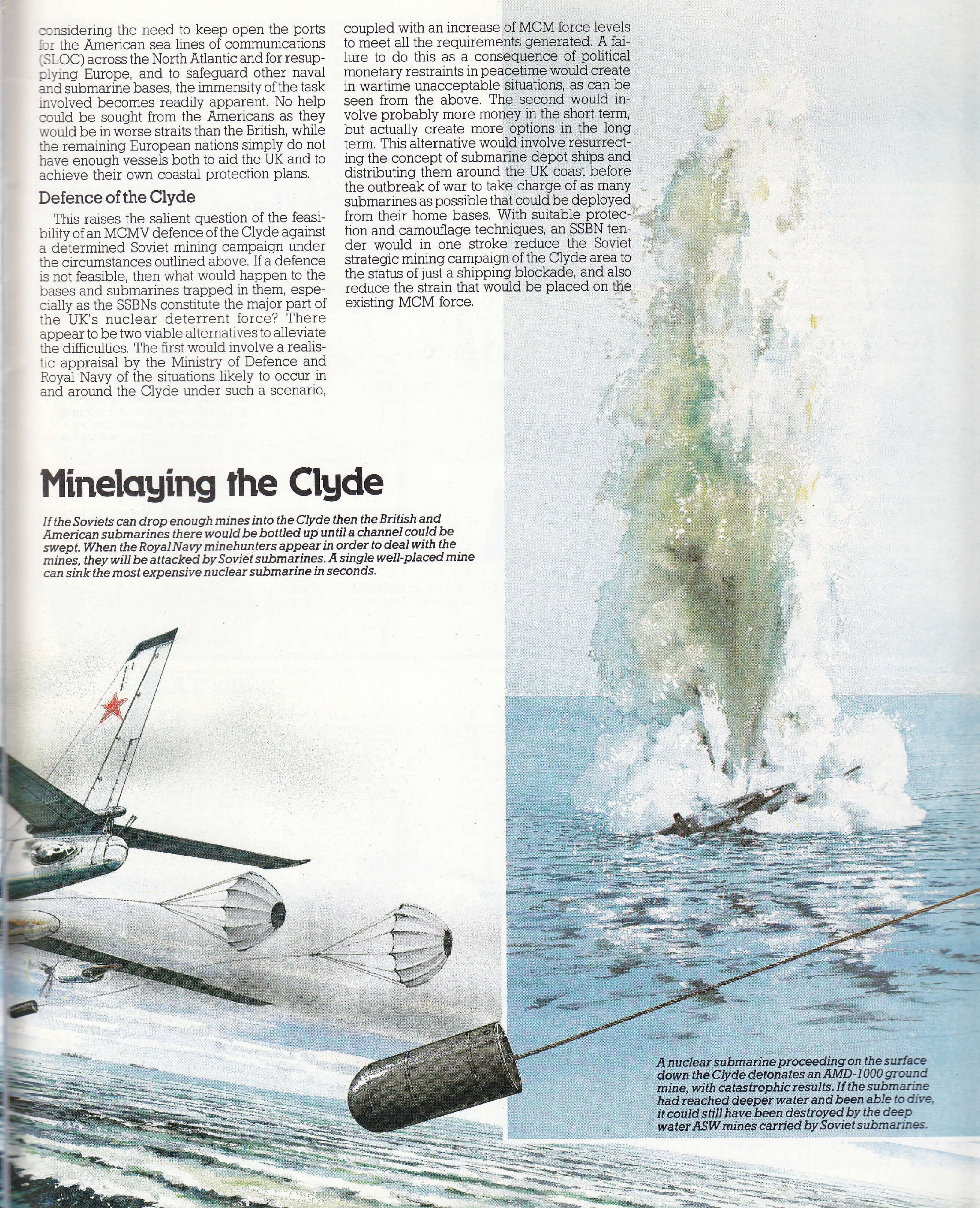
considering the need to keep open the ports for the American sea lines of communications (SLOC) across the North Atlantic and for resupplying Europe, and to safeguard other naval and submarine bases, the immensity of the task involved becomes readily apparent. No help could be sought from the Americans as they would be in worse straits than the British, while the remaining European nations simply do not have enough vessels both to aid the UK and to achieve their own coastal protection plans.

Defence of the Clyde

This raises the salient question of the feasibility of an MCMV defence of the Clyde against a determined Soviet mining campaign under the circumstances outlined above. If a defence is not feasible, then what would happen to the bases and submarines trapped in them, especially as the SSBNs constitute the major part of the UK's nuclear deterrent force? There appear to be two viable alternatives to alleviate the difficulties. The first would involve a realistic appraisal by the Ministry of Defence and Royal Navy of the situations likely to occur in and around the Clyde under such a scenario, coupled with an increase of MCM force levels to meet all the requirements generated. A failure to do this as a consequence of political monetary restraints in peacetime would create in wartime unacceptable situations, as can be seen from the above. The second would involve probably more money in the short term, but actually create more options in the long term. This alternative would involve resurrecting the concept of submarine depot ships and distributing them around the UK coast before the outbreak of war to take charge of as many submarines as possible that could be deployed from their home bases. With suitable protection and camouflage techniques, an SSBN tender would in one stroke reduce the Soviet strategic mining campaign of the Clyde area to the status of just a shipping blockade, and also reduce the strain that would be placed on the existing MCM force.

Minelaying the Clyde

If the Soviets can drop enough mines into the Clyde then the British and American submarines there would be bottled up until a channel could be swept. When the Royal Navy minehunters appear in order to deal with the mines, they will be attacked by Soviet submarines. A single well-placed mine can sink the most expensive nuclear submarine in seconds.



A nuclear submarine proceeding on the surface down the Clyde detonates an AMD-1000 ground mine, with catastrophic results. If the submarine had reached deeper water and been able to dive, it could still have been destroyed by the deep water ASW mines carried by Soviet submarines.

UK

'Hunt' class

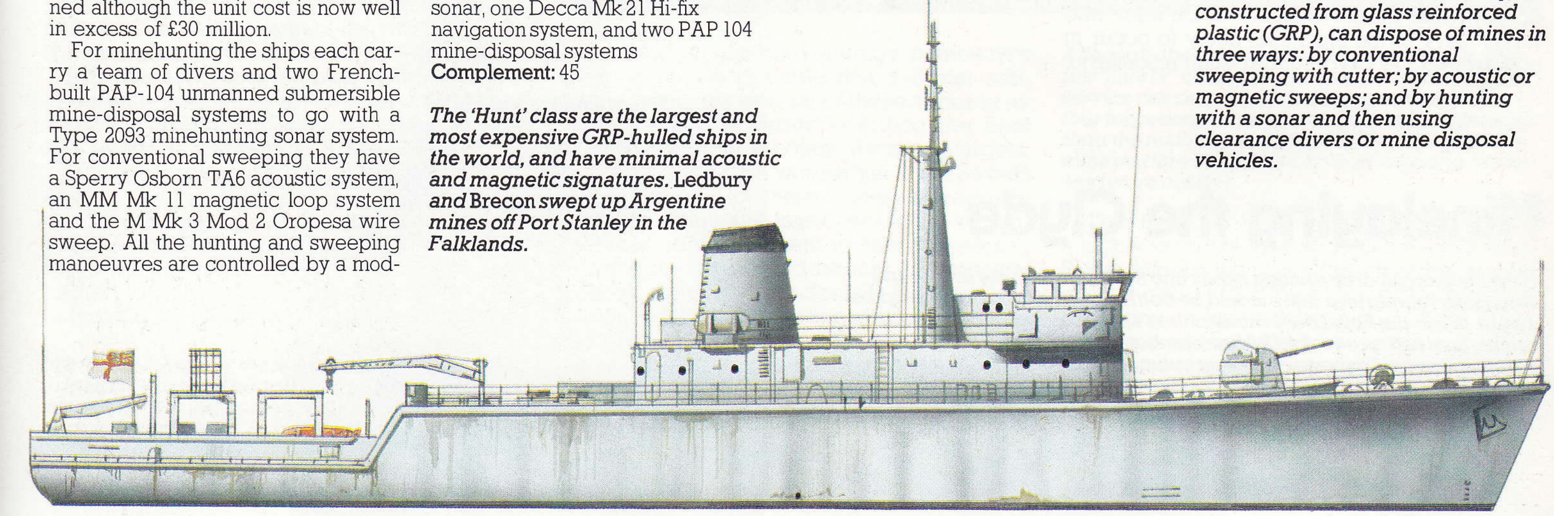
At the same time that the first GRP-built minehunter, HMS *Wilton* (M1116), was being built on the lines of the 'Ton' class, work began on the new generation of mine-countermeasures vessels capable of undertaking both minesweeping and minehunting operations. The result was the **'Hunt' class**, named after various hunt meetings around the UK. They are the largest and most expensive GRP-hulled ships in the world, every effort having been made to minimize the ships' magnetic signatures and to cut radiated noise levels underwater, while maintaining a capability for deep-sea passages to any part of the world. Eight are now in service with the Royal Navy, namely HMS ***Brecon*** (M29), ***Ledbury*** (M30), ***Cattistock*** (M31), ***Cottesmore*** (M32), ***Brocklesbury*** (M33), ***Middleton*** (M34), ***Dulverton*** (M35) and ***Chiddingfold*** (M37). Another three are building as HMS ***Atherstone*** (M36), ***Bicester*** (M37) and ***Hurworth*** (M39). Several more are believed to be planned although the unit cost is now well in excess of £30 million.

For minehunting the ships each carry a team of divers and two French-built PAP-104 unmanned submersible mine-disposal systems to go with a Type 2093 minehunting sonar system. For conventional sweeping they have a Sperry Osborn TA6 acoustic system, an MM Mk 11 magnetic loop system and the M Mk 3 Mod 2 Oropesa wire sweep. All the hunting and sweeping manoeuvres are controlled by a modified CAAIS action information data system in the operations room, using high-precision navigation aids. Both the *Brecon* and the *Ledbury* were used successfully after the 1982 Falklands war to sweep Argentine minefields that had been laid off Port Stanley. They were used in conjunction with a number of specially chartered commercial trawlers converted to the minesweeping role for the war.

Specification

'Hunt' class
Displacement: 615 tons standard and 725 tons full load
Dimensions: length 60.0 m (197.0 ft); beam 10.0 m (32.8 ft); draught 3.4 m (11.2 ft)
Propulsion: two diesels delivering 2834 kW (3,800 hp) to two shafts
Speed: 17 kts
Armament: one 40-mm Bofors AA gun
Electronics: one Type 1006 navigation radar, one CAAIS action information system, one Type 2093 minehunting sonar, one Decca Mk 21 Hi-fix navigation system, and two PAP 104 mine-disposal systems
Complement: 45

The 'Hunt' class mine countermeasures vessel Ledbury, *constructed from glass reinforced plastic (GRP), can dispose of mines in three ways: by conventional sweeping with cutter; by acoustic or magnetic sweeps; and by hunting with a sonar and then using clearance divers or mine disposal vehicles.*



The 'Hunt' class are the largest and most expensive GRP-hulled ships in the world, and have minimal acoustic and magnetic signatures. Ledbury *and* Brecon *swept up Argentine mines off Port Stanley in the Falklands.*

UK

'River' class

Based on a North Sea oilrig supply ship design, the **'River' class** of fleet minesweeper is gradually replacing the worn-out 'Ton' class coastal minesweepers assigned to the Royal Navy Reserve. The first four are HMS ***Waveney*** (M2003), ***Carron*** (M2004), ***Dovey*** (M2005) and ***Helford*** (M2006), and these entered service in 1984. The remaining eight are due at regular intervals: these ships are HMS ***Humber*** (M2007), ***Blackwater*** (M2008), ***Itchen*** (M2009), ***Helmsdale*** (M2010), ***Orwell*** (M2011), ***Ribble*** (M2012), ***Spey*** (M2013) and ***Arun*** (M2014).

All carry the BAJ-Vickers Mk 9 Extra-Deep Armed Team Sweep (EDATS) gear, with which two vessels work together, towing a sweep wire with special depth-keeping gear between them, that allows the cutting equipment to follow the contours of the sea-bed closely at very great depths. Explosive charges are attached at 91.4-m (300-ft) intervals to assist the mechanical cutters to break mooring chains.

The need for such a system has been generated by the Soviets' acquisition of rising mine and underwater electrical potential mine types, which can be laid in deep water on the continental shelf and rise regions for use against transitting dived nuclear submarines. The deep-sweep concept was originally tested in 1977-8, when the Royal Navy briefly chartered six commercial trawlers for the series of 'Highland Fling' minesweeping exercises off Scotland. Two more trawlers were then chartered for six years apiece late in 1978 to explore more fully the idea and develop it into the EDATS system. The two vessels were commissioned into the Royal Navy Reserve as HMS *Venturer* (M08) and *St David* (M07).

Lead ship of the 'River' class minesweepers is the Waveney. *Steel-hulled, she is fitted with the EDATS sweep for the deep team sweeping role against Soviet deep water mines laid to catch British and American submarine traffic off the Scottish coasts.*

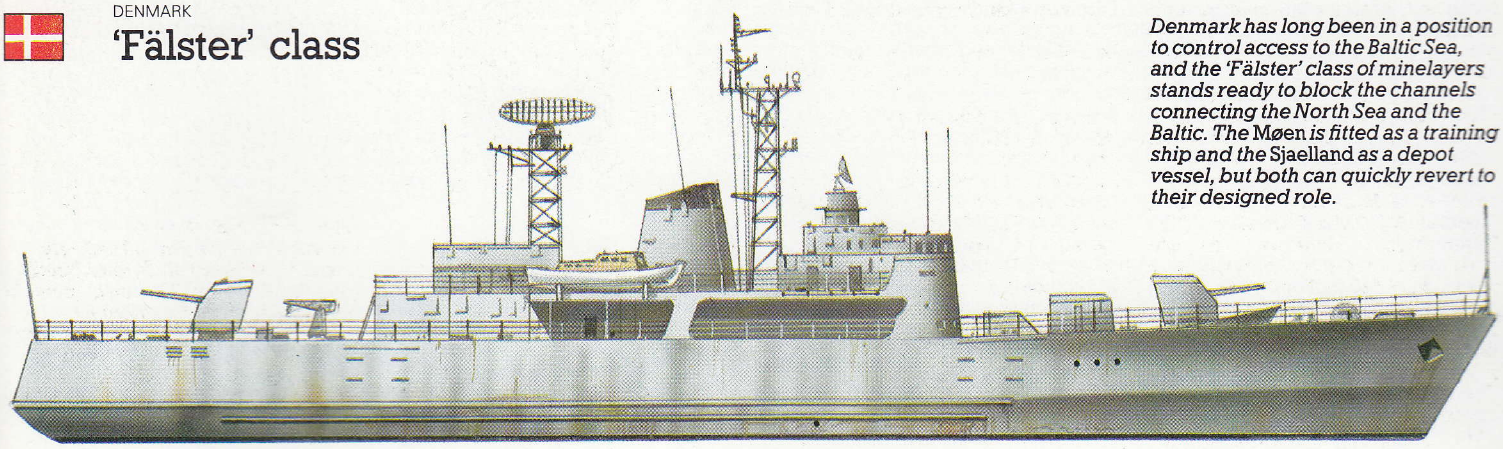
'River' class (continued)

Specification
'River' class
Dimensions: length 47.5 m (156.0 ft); beam 10.5 m (34.5 ft); draught 3.1 m (10.3 ft)
Propulsion: two diesels delivering 2267 kW (3,040 hp) to two shafts
Speed: 14 kts
Armament: two 7.62-mm (0.3-in) machine-guns, and for but not with one 40-mm Bofors AA gun
Electronics: two Decca RM1226 navigation radars, one Decca QM14 navigation system, one Decca Mk 6 Hi-fix navigation system, one satellite navigation system, and sonar
Complement: 30

The Dovey was third of the 'River' class to be commissioned. In peacetime the class are allocated to the various RNR divisions, except for one which may be used for trial purposes to test new deep sweeping technology.

DENMARK

'Fälster' class



Denmark has long been in a position to control access to the Baltic Sea, and the 'Fälster' class of minelayers stands ready to block the channels connecting the North Sea and the Baltic. The Møen is fitted as a training ship and the Sjaelland as a depot vessel, but both can quickly revert to their designed role.

Because of the strategic nature of Denmark's position across the entrance and exit to the Baltic Sea, the Danish navy has invested part of its defensive capabilities in minelayers. The largest of the three types currently in use is the NATO-designed **'Fälster' class** of four ships. Named after Danish islands, the ***Fälster*** (N80), ***Fyen*** (N81), ***Møen*** (N82) and ***Sjaelland*** (N83) were ordered in 1960-1 and launched in 1962-3. They have a flushdecked steel hull with a raking stern through which four minelaying tracks are run to lay the mines. There is also a near sistership, the ***Nusret*** (N110) launched in Denmark in 1964, serving with the Turkish navy as a minelayer. In peacetime the class is generally used on other duties, with the *Møen* converted to a midshipman training ship with specialist ECN gear aboard, and the *Sjaelland* converted in 1976 to act as a depot ship for Denmark's small fleet of conventional submarines and torpedo/missile boats. In wartime both units would revert to the minelaying role with only minimal internal changes. When the *Møen* is unavailable for training duties the *Fyen* is used instead. The class can lay both moored and ground mine types.

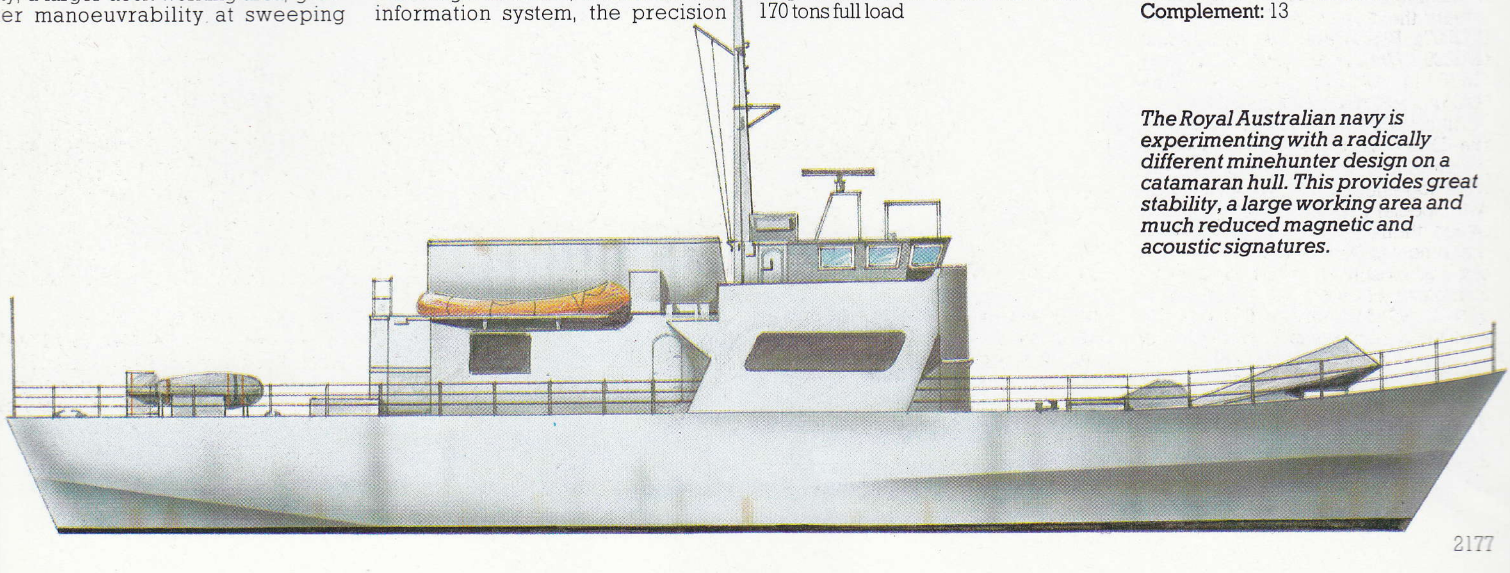
Specification
'Fälster' class
Displacement: 1,800 tons standard and 1,900 tons full load
Dimensions: length 77.0 m (252.6 ft); beam 12.8 m (42.0 ft); draught 3.6 m (11.8 ft)
Propulsion: two diesels delivering 3579 kW (4,800 hp) to two shafts
Speed: 16.5 kts
Armament: two twin 76-mm (3-in) Mk 33 DP guns, and up to 400 mines
Electronics: one NWS2 navigation radar, one MWS1 tactical radar, one WM-46 fire-control system, one CWS2 air- and surface-search radar, two 57-mm multi-barrel chaff-rocket launchers, and (*Møen* only) one ECM system
Complement: 119

AUSTRALIA

'MHCAT' class

The **'MHCAT' class** of inshore minehunter is the first design of a totally new concept in mine countermeasures. The first two units, HMAS ***Rushcutter*** and ***Shoalwater***, are being built as prototypes to a catamaran hull form with foam sandwich-filled fibreglass hulls that are 3 m (9.8 ft) in the beam and some 3 m (9.8 ft) apart. This arrangement provides greater stability, a larger deck working area, greater manoeuvrability at sweeping speeds, and a significant reduction in the magnetic/acoustic signatures by placing the heavier machinery above the waterline high up in the vessel. Each hull has a single propeller, and the victualling consists of pre-prepared foodstuffs. The sweep gear is fully containerized to allow for rapid removal or replacement. Four subsystems are located in the container aft of the bridge: the sonar, the tactical data information system, the precision navigation system and the mine disposal weapon-control unit. The last directs either of the two French-made PAP 104 unmanned wire-guided submersible vehicles carried on the aft working deck. The Royal Australian Navy plans to order a further four.

Specification
'MHCAT' class
Displacement: 100 tons standard and 170 tons full load
Dimensions: length 31.0 m (101.7 ft); beam 9.0 m (29.5 ft); draught 2.0 m (6.6 ft)
Propulsion: two diesels delivering 485 kW (650 hp) to two shafts
Speed: 10 kts
Armament: two 7.62-mm (0.3-in) machine-guns
Electronics: one navigation radar, one DSQS-11H minehunting sonar, and two PAP 104 mine-disposal systems
Complement: 13



The Royal Australian navy is experimenting with a radically different minehunter design on a catamaran hull. This provides great stability, a large working area and much reduced magnetic and acoustic signatures.

Minesweeping Techniques

Naval mines became increasingly sophisticated during World War II, Germany in particular developing pre-set neutralization devices to defeat Allied minesweeping techniques. Today, there is an undeclared war between the users of the world's sea lanes and those who would seek to close them in time of conflict.

The mine warfare forces of the Western nations have to face a number of Soviet mine types which can be laid in water depths of a few metres to some 600 m (1,970 ft). In order to defeat these weapons a variety of sweeping techniques has been adopted, ranging from those used in World War II to new ones developed where needed. The commonest type is the wire sweep, which is used against moored floating contact (and sometimes influence) mines. In NATO this is known as the Oropesa, and consists of a single wire which usually has a steel torpedo-shaped float attached to its outer end. In order to make the sweep travel at the required depth right along its length, an 'Otter' board is connected to the end beneath the float and, after all the wire has been run out, a 'Kite' board beneath the end under the sweeper. A minesweeper can operate either a single Oropesa to one side and astern of the ship, or a double set to cover each side. Once a channel has been swept of mines it is marked as safe by dan-buoys.

In sweeping or hunting operations, precise navigation is critical because of the need to record any minefield found and to ensure a safe passage is marked for future traffic.

To defeat the normal sweep gear enemies would use mine destructor devices designed to wreck the cutting gear, and delayed-action buoyant mines which would sit on the bottom with their mooring anchor and chain until a specified time had passed before being released to act as standard moored mines.

A modified version of the towed sweep has been developed by the Royal Navy for use against Soviet deep-water mine types. Using the same cutter/explosive charge technique as the Oropesa for cutting a mooring chain, the BAJ-Vickers Mk 9 Extra-Deep Armed Team Sweep requires two 'River' class fleet minesweepers to work it.

For the more complex magnetic mine types, the technique used is to tow two long buoyant electric cables of unequal length connected to a large generator aboard the sweeping vessel, which has a non-magnetic hull and fittings. By pulsing the electric power to the cables on and off at varying intervals, a magnetic field is created that simulates a steel-hulled ship passing through the Earth's magnetic field. Depending upon the strength and pattern of the pulses, any magnetic mine designed to attack the type of ship being simulated will be triggered if it lies within the sweep's sphere of influence.

Similarly, the sweeping of acoustic mines requires an acoustic generator towed behind the vessel on a long cable with a second shorter cable connected to an acoustic monitor in front of it. This listens to the noise produced by the generator and regulates it to maintain a constant output so as to simulate a single class of ship.

For the multi-influence mine that uses both acoustic and magnetic triggering influences, the sweeper must use both sweeps together to defeat the mine.

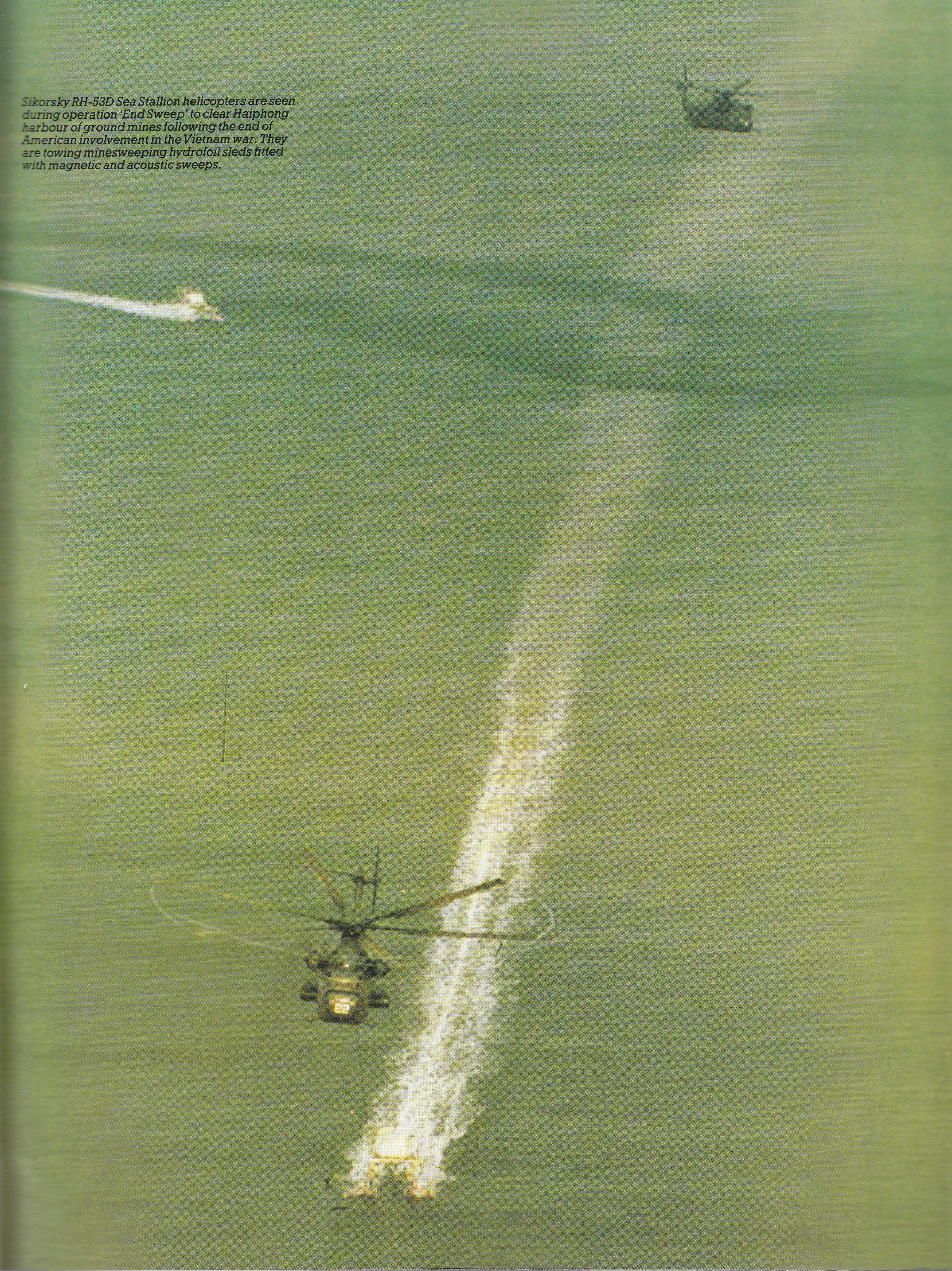
Problems really arise, however, when a pressure-actuated firing mechanism is considered. The only sure way to defeat this type (as itself or combined with either or both the other two influence triggers) is by detecting it on the sea bed by the use of a minehunter equipped with high-resolution sonar and then destroying it with an HE charge laid either by a diver or, preferably, by a remotely controlled submersible. Such vessels tend to be rather expensive, however, and this role is usually combined with that of conventional minesweeping in a single mine countermeasures vessel (MCMV) to save money.

In order for the hunting to be successful, very accurate mapping of all the objects that resemble a mine on the sea floor around a port must be undertaken and the maps kept up to date, otherwise in wartime a hunt could very well be made against a piece of rubbish rather than an actual mine casing. One way to defeat this method of sweeping is either to ensure that the mine is buried in silt or to camouflage it with an anechoic coating to absorb active sonar transmissions, as the Soviets do on their submarines. This forces the minehunter to investigate more closely (with divers or submersibles) each contact where such mines are believed to have been laid. This leaves the vessel and its equipment open to a special category of multi-influence ground mine which the Soviets have developed to destroy or damage NATO MCM vessels. Also, acoustic and magnetic sweeps can be defeated by fitting the mines with pre-set neutralization devices to keep them inert until a certain time has passed (the Germans used delays of up to 200 days on some of their mines in World War II, so the Soviets must have systems at least as long as this) while ship-counter or firing-pulse delay mechanisms can also be used to delay the mine detonation until a set number of actuations has been received. There is also the possibility in multi-influence mines of using the different influence-actuation systems set to different times so that, for example, a quick one-second magnetic pulse could be used to arm the mine while the detonation would require an acoustic build up over some 10 seconds to ensure that it was a ship and not a sweep that was causing the activation. Each combination of the influences would require a suitable response from the MCM force in order to sweep all the mines laid in, for example, a ground mine field. This would take a considerable time and achieve the result required of a minefield, which is to disrupt and deny sea room to an enemy's maritime operations.

The Americans, Soviets, Japanese and Swedes have also introduced minesweeping helicopters into their armed forces. Although offering greater flexibility than surface ships under some circumstances, in terms of speed and shallow-water operations, the helicopter cannot be used against deep-water mines, whereas the surface ship can. The Americans are probably the leading exponents of this technique with their Sikorsky RH-53D Sea Stallion and MH-53E Super Stallion helicopters. The former has seen actual operations in clearing the waters of North Vietnam after the Vietnam War, the Suez Canal Zone and recently the Red Sea. The sweeps used are mainly similar to the shipborne types but mounted on hydrofoil sleds for fast towing.

The other major area in MCM work which shows promise is the use of air-cushion vehicles both for sweeping and hunting. In trials by the Royal Navy such vessels have proved almost invulnerable to underwater mine explosions and superbly successful in these roles, but as with other developments that the Royal Navy investigates there is a lethargic and apathetic response in applying such innovations to fleet use. This is not so in the Soviet navy, which is believed to have investigated the same ACV roles and produced systems for use by its large force of ACV types.

The 'Catherine' class fleet sweeper Foam *operates an 'A' type towed wire sweep with the 'Algerine' class fleet sweeper* Bramble *in late 1945. The 'A' sweep was used extensively in World War I but seldom in World War II, as it limited the sweeper's manoeuvrability.*



Sikorsky RH-53D Sea Stallion helicopters are seen during operation 'End Sweep' to clear Haiphong harbour of ground mines following the end of American involvement in the Vietnam war. They are towing minesweeping hydrofoil sleds fitted with magnetic and acoustic sweeps.

ITALY

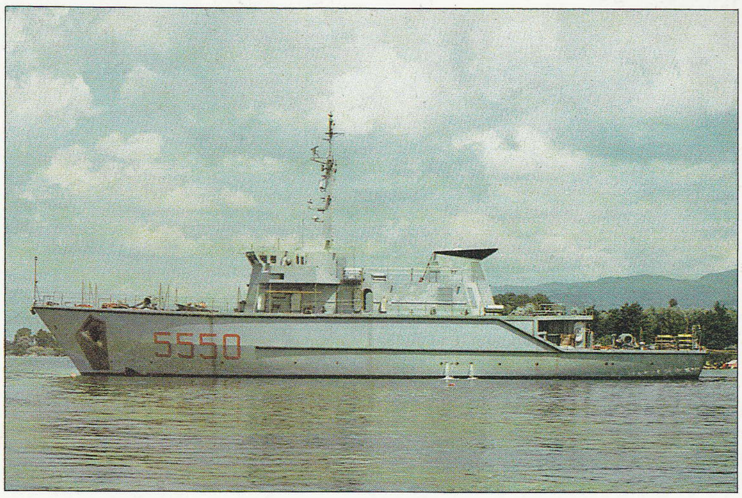
'Lerici' class

The first four units of the **'Lerici' class** of mine countermeasures vessels (MCMVs) were ordered in January 1978 under the Legge Navale plan from Intermarine at Sarzona. Delayed for a while because of a bridge they could not pass beneath until it was rebuilt, they are constructed of heavy GRP shock-resistant materials, and are equipped to carry a locally designed and built MIN-79 minehunting submersible as well as six divers with CAM mine destructor charges. The sonar used is a licence-built version of the US 'Squeaky Fourteen' (SQQ-14) system, modified into a variable-depth set which is lowered from the keel forward of the bridge.

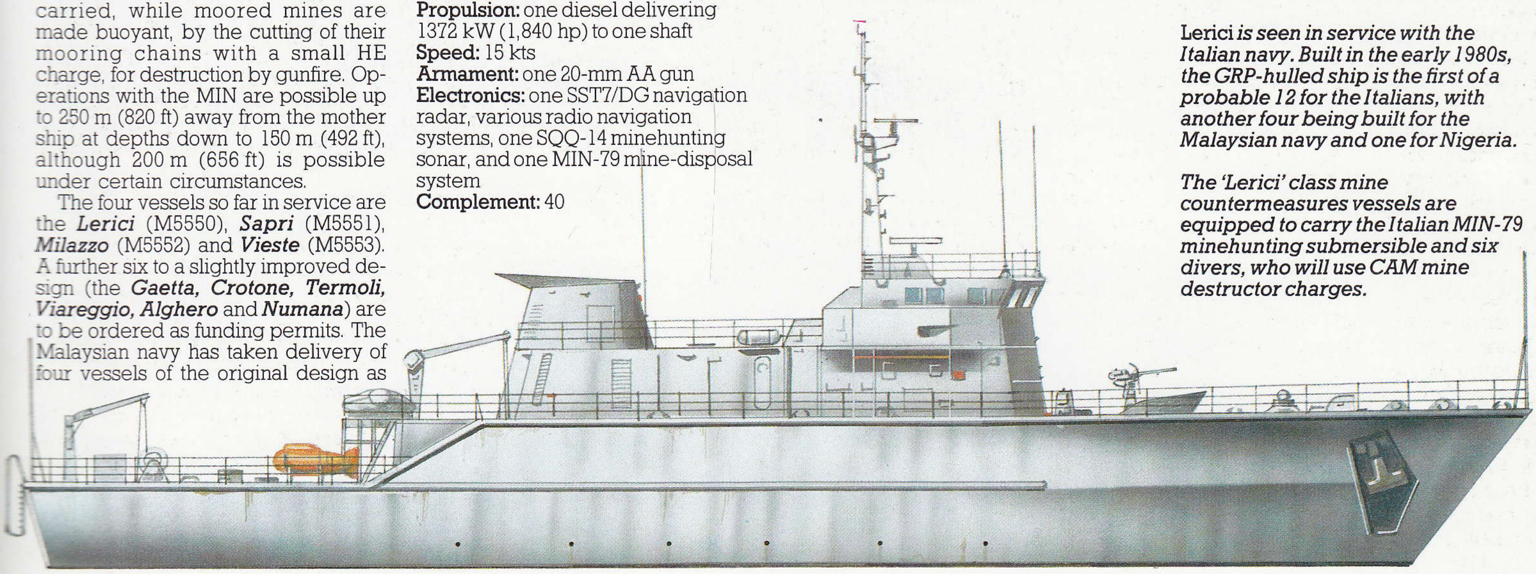
The 5-kt MIN system consists of a 1300-kg (2,866-lb) GRP vehicle fitted with a sonar and an underwater TV camera. For destruction of ground mines an 85-kg (187-lb) HE charge is carried, while moored mines are made buoyant, by the cutting of their mooring chains with a small HE charge, for destruction by gunfire. Operations with the MIN are possible up to 250 m (820 ft) away from the mother ship at depths down to 150 m (492 ft), although 200 m (656 ft) is possible under certain circumstances.

The four vessels so far in service are the ***Lerici*** (M5550), ***Sapri*** (M5551), ***Milazzo*** (M5552) and ***Vieste*** (M5553). A further six to a slightly improved design (the ***Gaetta, Crotone, Termoli, Viareggio, Alghero*** and ***Numana***) are to be ordered as funding permits. The Malaysian navy has taken delivery of four vessels of the original design as the ***Mahamiru*** (M11), ***Jerai*** (M12), ***Ledang*** (M13) and ***Kinabula*** (M14) to replace old British 'Ton' class vessels, while the Nigerian navy has ordered one with a second on option to establish an MCMV force. The Malaysian craft are fitted with French Ibis minehunting sonars and two improved PAP 104 mine disposal systems, while the Nigerian unit(s) will be of the standard type except for carrying the smaller Pluto remote controlled submersible system. All units also carry an Oropesa wire sweep for dealing with moored mines.

Specification
'Lerici' class
Displacement: 470 tons standard and 502 tons full load
Dimensions: length 50.0 m (164.0 ft); beam 9.6 m (31.5 ft); draught 2.6 m (8.5 ft)
Propulsion: one diesel delivering 1372 kW (1,840 hp) to one shaft
Speed: 15 kts
Armament: one 20-mm AA gun
Electronics: one SST7/DG navigation radar, various radio navigation systems, one SQQ-14 minehunting sonar, and one MIN-79 mine-disposal system
Complement: 40



***Lerici** is seen in service with the Italian navy. Built in the early 1980s, the GRP-hulled ship is the first of a probable 12 for the Italians, with another four being built for the Malaysian navy and one for Nigeria.*



The 'Lerici' class mine countermeasures vessels are equipped to carry the Italian MIN-79 minehunting submersible and six divers, who will use CAM mine destructor charges.

USA

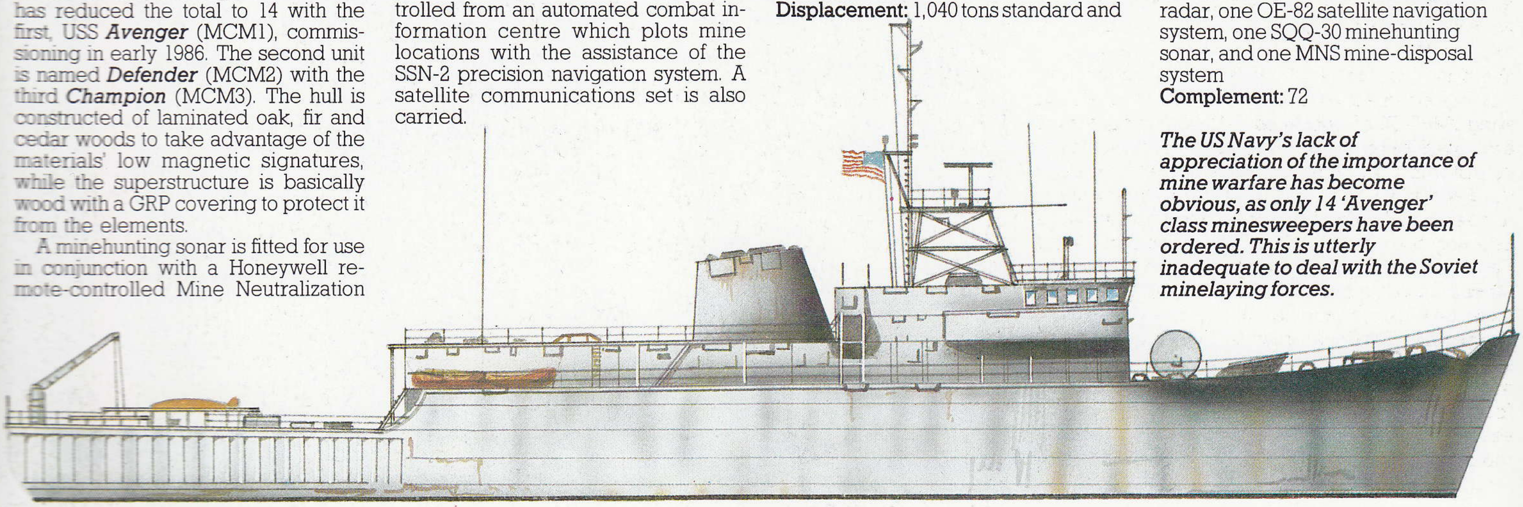
'Avenger' class

To replace the ageing 'Aggressive' and 'Acme' class ocean minesweepers, the design of a new type of MCMV was begun in 1970. This eventually evolved into the **'Avenger' class**, of which 21 were originally planned to be built over the next 10-15 years. However, cutbacks and what can only be described as a complete lack of understanding of mine warfare in senior US naval and political circles has reduced the total to 14 with the first, USS ***Avenger*** (MCM1), commissioning in early 1986. The second unit is named ***Defender*** (MCM2) with the third ***Champion*** (MCM3). The hull is constructed of laminated oak, fir and cedar woods to take advantage of the materials' low magnetic signatures, while the superstructure is basically wood with a GRP covering to protect it from the elements.

A minehunting sonar is fitted for use in conjunction with a Honeywell remote-controlled Mine Neutralization System (MNS) to sweep ground mines and deep-moored mines down to a depth of 183 m (600 ft). Later the class will be retrofitted with the new SQQ-32 variable-depth minehunting sonar as it becomes available. For conventional minesweeping tasks A Mk 4 and A Mk 6 acoustic sweeps, M Mk 5, M Mk 6 and M Mk 7 magnetic sweeps and an Oropesa No. 1 wire sweep are shipped. The single MNS vehicle is controlled from an automated combat information centre which plots mine locations with the assistance of the SSN-2 precision navigation system. A satellite communications set is also carried.

The 'Avenger' class will be complemented in service by the **'Cardinal' class** of minehunters, of which 17 are planned. Equipped with the SQQ-30 minehunting sonar, these will have a GRP hull with mechanical, magnetic and acoustic sweeps plus an MNS system.

Specification
'Avenger' class
Displacement: 1,040 tons standard and 1,240 tons full load
Dimensions: length 68.3 m (224.0 ft); beam 11.9 m (39.0 ft); draught 3.5 m (11.4 ft)
Propulsion: four diesels delivering 1790 kW (2,400 hp) to two shafts
Speed: 14 kts
Armament: two 12.7-mm (0.5-in) machine-guns
Electronics: one SPS-55 surface-search radar, one SPS-56 navigation radar, one OE-82 satellite navigation system, one SQQ-30 minehunting sonar, and one MNS mine-disposal system
Complement: 72



The US Navy's lack of appreciation of the importance of mine warfare has become obvious, as only 14 'Avenger' class minesweepers have been ordered. This is utterly inadequate to deal with the Soviet minelaying forces.

West Germany

Part 3

The Navy

The Federal German navy has, as part of NATO's maritime forces, the responsibility for the majority of operations in the Baltic and North Sea, and also for the defence of its own frontiers. In wartime its primary role would switch to defending the entrances to these areas in co-operation with other NATO naval, ground and air forces against the strong Warsaw Pact forces. To carry out its assigned missions the Federal German navy has a strength of 31,800 officers and men, and has evolved a mostly indigenous fleet of destroyers, frigates, submarines and light forces designed to operate specifically in these regions. For the more open North Sea the main units used are the guided missile destroyers of the 'Lütjens' and 'Hamburg' classes, backed up by the 'Bremen' class of missile frigates plus the remaining three 'Köln' class units. The roles for these vessels include the escort of convoys against submarine and air attacks, defence against surface craft missile attack and, for the older 'Köln' and 'Hamburg' classes, offensive and defensive minelaying. For the Baltic the emphasis switches to the smaller light forces, which comprise a mixture of fast attack craft equipped with MM.38 Exocet anti-ship missiles and fast minehunters and minesweepers. The MCM vessels can also double as coastal patrol craft and minelayers if required. There is also a small number of corvettes for the coastal ASW role.

To aid both groups of surface ships in their operational zones the Federal German navy has also developed a force of coastal submarines based on technology that has its roots in the vast Kriegsmarine submarine programme of World War II. Built in two classes, the 'Type 205' and 'Type 206', these vessels carry eight bow torpedo tubes of the 533-mm (21-in) 'swim-out' type for wire-guided ASW and anti-ship torpedoes. In place of the eight torpedoes 16 ground influence mines can be carried in the tubes, although the 'Type 206s' have the additional facility of being fitted with a GRP container secured to the hull on each side. These containers hold 12 mines apiece and can be carried as an external 'mine-belt' in addition to the standard torpedo load, such a combination being ideally suited for operations in the Baltic.

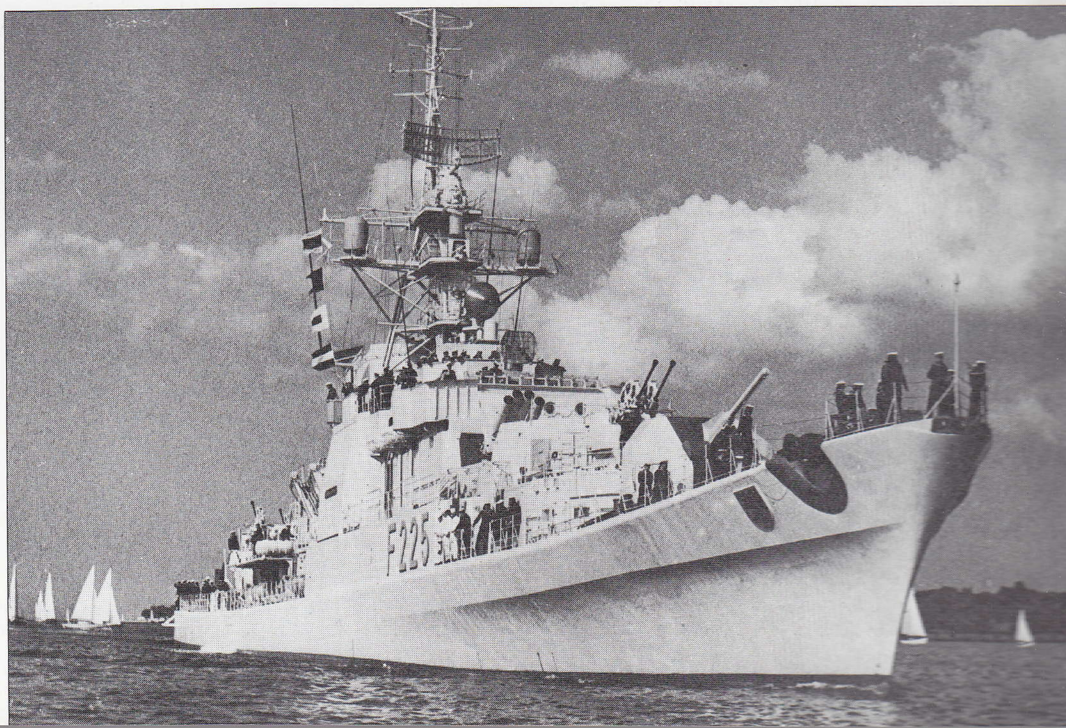
The Federal German navy also has a naval air arm of 6,700 officers and men, and this is primarily tasked for the anti-shipping role with ASW as its secondary mission. For the latter there is a fleet of Dassault-Breguet Atlantic maritime patrol aircraft equipped with air-dropped American Mk 44 and Mk 46 ASW torpedoes, and with conventional depth bombs. These are now being aided by a force of Westland Lynx HAS.Mk 88 helicopters fitted with dipping sonars aboard the 'Bremen' class frigates. A wing (MFG 2) of Lockheed F-104G Starfighters is employed for the primary role, and serves alongside its sister unit (MFG 1), which has just converted to the Panavia Tornado. The former unit is scheduled to re-equip with the Tornado in 1986-7. Both wings use iron bombs, unguided rockets and the MBB Kormoran air-to-surface missile in their anti-shipping strikes. To locate the targets a specialist reconnaissance unit flies a number of Lockheed RF-104G Starfighters fitted with camera pods and other sensors. For the more covert electronic intelligence mission there are several converted Atlantics, plus four converted naval and ex-commercial surface vessels. The aircraft regularly fly over the Baltic to monitor the various Warsaw Pact naval exercises, while the ships operate in a manner similar to that employed by Soviet AGI trawlers.

FGS Rhein *is the name-ship of the Type 401-2-3 class depot ships and serves with the 3rd Fast Patrol Boat squadron. Displacing 2,940 tons at full load, she is armed with two 100-mm (3.9-in) and four 40-mm (1.57-in) guns, and carries a crew of 153.*

To back the combat units there is a considerable infrastructure of support vessels available. Foremost among these are the 10 'Rhein' class armed tenders, which allow the various submarines and light force squadrons to operate away from their home bases in wartime. Resupply of weapons, stores and spares is performed by a series of replenishment ship types based on a single hull design. Fuel and water replenishment is undertaken by a number of mostly ex-merchant tankers that have been refitted for underway resupply operations.

For the future the Federal German navy already has a number of new ship designs ready to enhance its overall capabilities. The older 'Type 205' and 'Type 206' submarines are to be replaced by the larger 'Type 211' design, while the remaining 'Type 206' units will be modernized in the period 1987-91 to form the 'Type 206A' class. The 'Lütjens' class destroyers are in the process of having their mid-life modernization refits that include installation of the Harpoon anti-ship missile system and replacement of the original Tartar SAM by the much improved Standard SM1-MR missile. The older 'Hamburg' class is due to be retained in service into the 1990s and will be fitted with a new computer action information system and the RAM point-defence SAM system. A further two 'Bremen' class frigates will be ordered in the late 1980s for deployment in the early 1990s. The remaining 'Köln' class frigates are shortly to be relegated to economic zone patrols, having their two gas turbine engines deactivated in the process. The similar-vintage 'Thetis' class ASW corvettes are already to be replaced by three new 'Type 423' class corvettes during 1990-3.

Seen here prior to her modernization, Schleswig-Holstein *is one of the German navy's four 'Hamburg' class destroyers. The X turret has now been replaced by four MM.38 Exocet missiles, the 40-mm Bofors guns replaced by Bredas and two more anti-submarine torpedo tubes fitted.*



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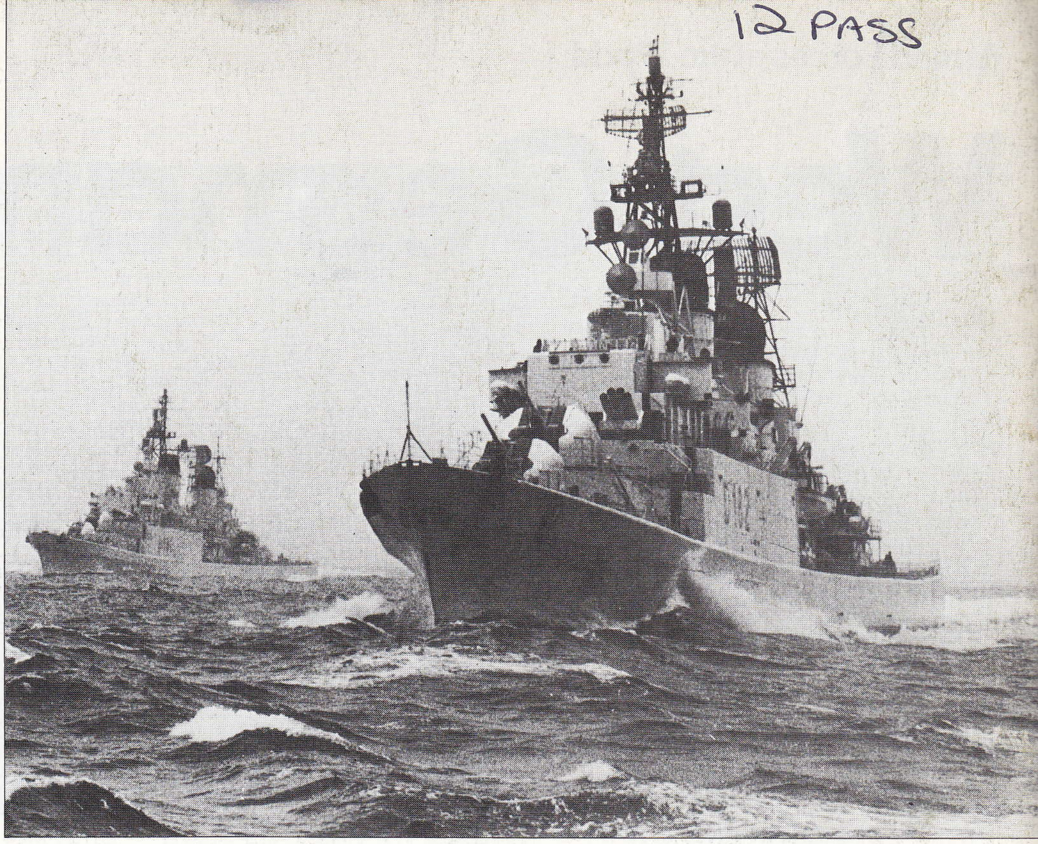
There is no need for any of the missile boats to be replaced at present since the most elderly is only 13 years old. However, the larger units are to undergo modernization to the same standard with new electronics and weapon systems as required.

In contrast the large number of MCM vessels do need replacement within the next decade or so. The 'Frauenlob' and 'Ariadne' classes of inshore minesweepers are to be replaced by a single 20-ship 'Type 332' design, while the replacement of the 'Lindau' and 'Schütze' classes will begin with the first of a dozen 'Type 343' dual-role minehunter-minelayer vessels in 1987. A new class of 12 minesweepers, the 'Type 355', is also projected to begin construction in the late 1980s or early 1990s; its role is to dispose of the 'unsweepable' pressure-actuated ground mine, of which the Soviets are known to have many thousands. There is currently no new vessels planned for the support services.

The naval air arm's major re-equipment programme is the introduction of the Tornado strike aircraft. However, to enhance further operational capabilities in the Baltic and North Sea, the force of Westland Sea King Mk 41 search and rescue helicopters flown by MFG 5 is to be refitted for missile attack and guidance duties. This is particularly useful for any operations that might involve the Harpoon-equipped surface ships. Apart from new ship classes there is a continuing programme of developing new torpedo and mine weapons that can operate in the particular marine environments that are encountered.



FGS **Braunschweig** *is being transferred to the Turkish navy, following her sisters* **Emden** *and* **Karlsruhe**, *as the 'Köln' class is replaced by the new 'Bremens'. Ordered in 1957, the 2,700-ton 'Kölns' formed the 2nd Frigate squadron.*

Federal German navy order of battle

submarines: six 'Type 205' and 18 'Type 206', plus 12 'Type 211' to be delivered in 1991-7
missile destroyers: three 'Type 103/103A' or 'Lütjens' class and four 'Type 101' or 'Hamburg' class
missile frigates: six 'Type 122' or 'Bremen' class, plus two more units planned
frigates: three 'Type 120' or 'Köln' class
corvettes: five 'Type 420' or 'Thetis' class, to be replaced in 1990-3 by three 'Type 423' class
missile craft: 10 'Type 143' class, 10 'Type 143A' class and 20 'Type 148' class
MCM vessels: two 'Type 381A' and 10 'Type 331B' or 'Lindau' class coastal minehunters, six 'Type 551' or 'Lindau' class drone-control minesweepers each with three HL351 Troika drones, eight 'Type 340' and 13 'Type 341' or 'Schütze' class coastal minesweepers, plus 10 'Type 394' or 'Frauenlob' class and eight 'Type 393' or 'Ariadne' class inshore minesweepers; new MCM classes are planned for the late 1980s and early 1990s
amphibious warfare vessels: 22 'Type 520' class LCUs and 22 'Type 521' class LCMs
auxiliaries: 10 armed tenders, 14 replenishment ships, two repair ships, nine replenishment tankers, four intelligence ships and more than 160 other craft

Federal German Naval Air Arm order of battle

Marinefliegergeschwader 1: 48 Panavia Tornados for anti-ship strike
Marinefliegergeschwader 2: 43 Lockheed F-104G Starfighters and 10 TF-104G Starfighters for anti-shipping strike and training duties respectively
Marinefliegergeschwader 3: 19 Dassault-Breguet Atlantics (14 for ASW and five for Elint)
Marinefliegergeschwader 5: 22 Westland Sea King Mk 41s for search and rescue
one squadron of 26 Lockheed RF-104G Starfighters for maritime reconnaissance
one squadron of 14 Westland Lynx HAS.Mk 88s for ASW and missile-targeting
one squadron of 20 Dornier Do 28D-2 liaison, one Hansa HFB32 ECM, four IAI Westwind target tugs and several Piaggio P.149D trainer aircraft

The 450-ton diesel-electric 'Type 206' submarines carry eight 533-mm (21-in) torpedo tubes. Crewed by four officers and 18 men, they have the uniquely German feature of a hull built of high-tensile non-magnetic steel. U-29 was commissioned in 1974 and can make 10 kts surfaced and 18 under water.